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JUNE 1970

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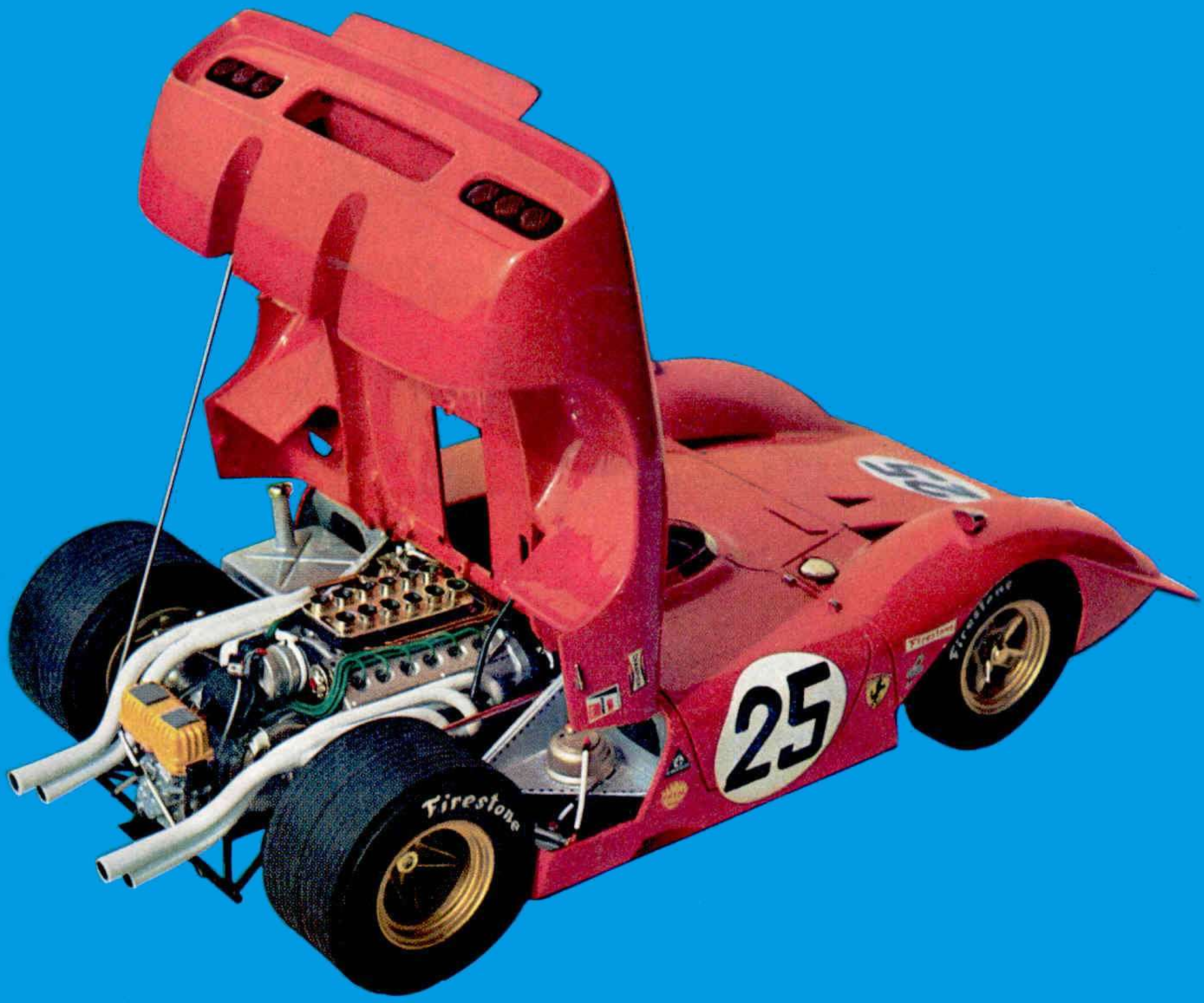
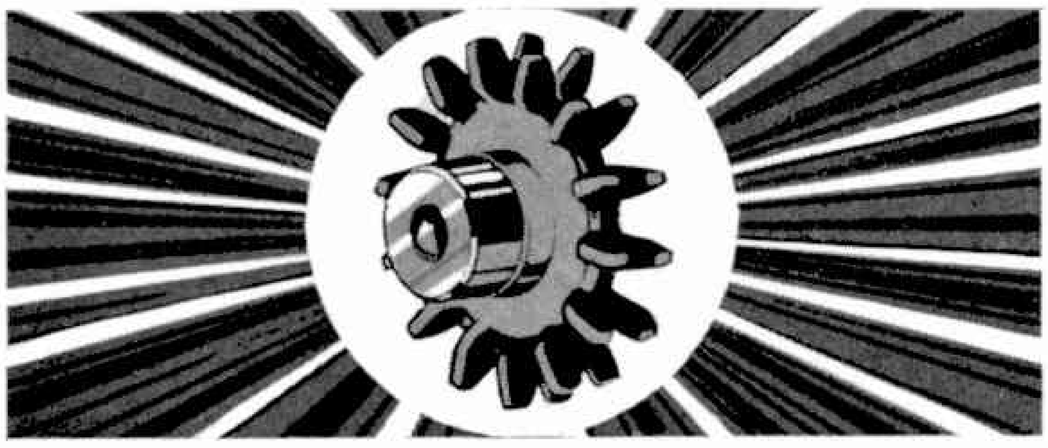
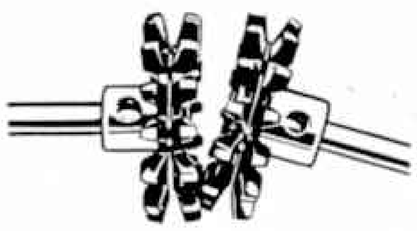


# NEW PARTS

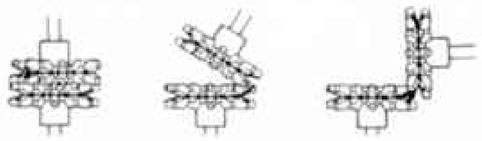
## The Fantastic New Gear Wheel - No. 27f



### AS A GEAR WHEEL

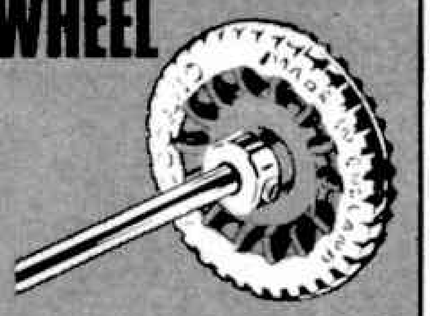


It will transmit drive at any angle



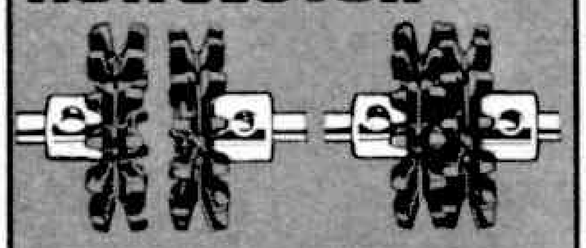
even up to 90°!

### AS A ROAD WHEEL



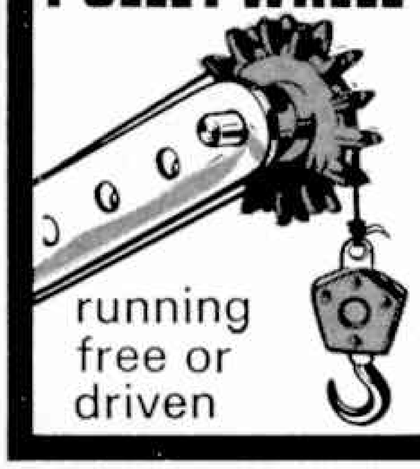
Fitted with a standard 1" tyre

### AS A CLUTCH

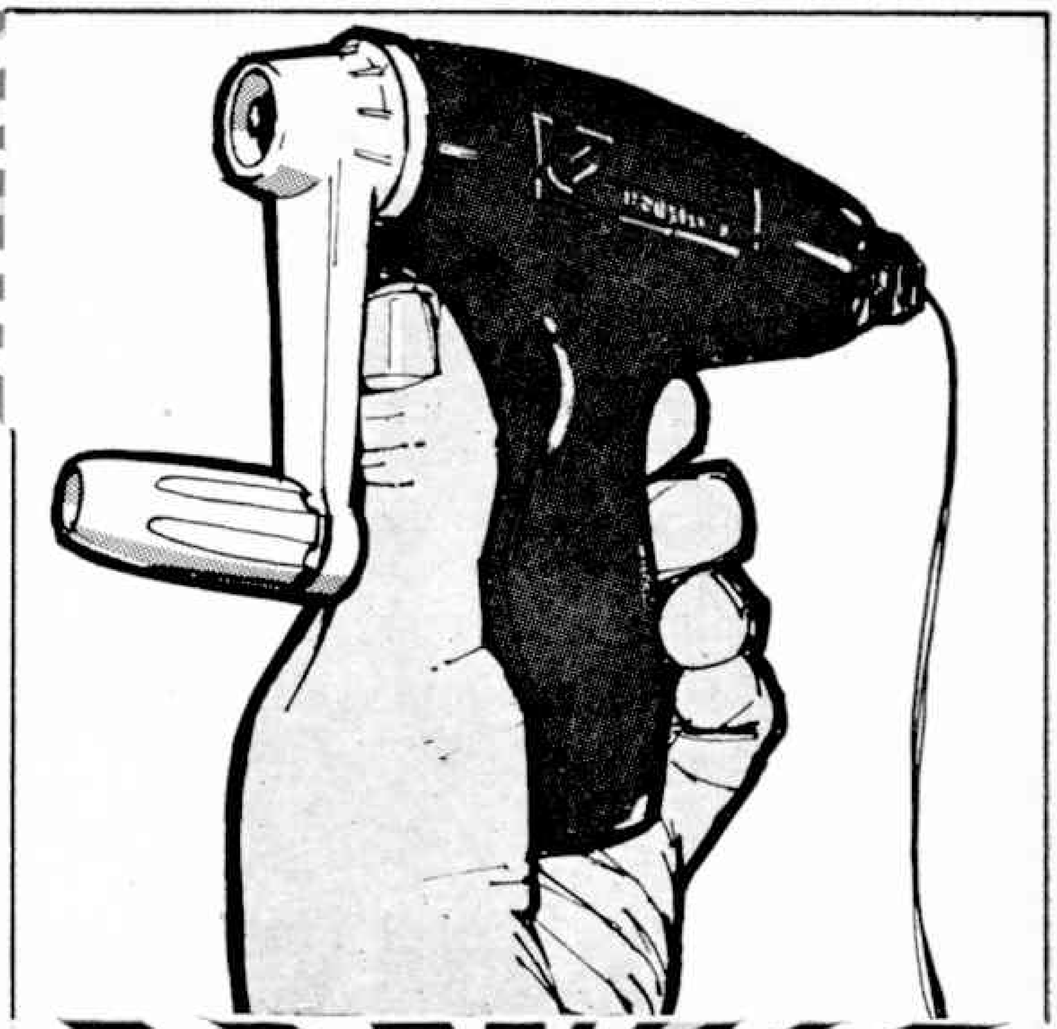


face to face

### AS A PULLEY WHEEL



running free or driven



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JUNE 1970 VOLUME 55 NUMBER 6

Meccano Magazine, founded 1916.

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## FRONT COVER

Ferrari 312/P in 1/11th scale completely scratch-built from brass sheet with complete engine detailing, working shock absorbers, opening doors and engine cover, etc. This incredible model is typical of Italian Master model maker, Michele Conti's work; acknowledged as one of the world's finest model car constructors, Michele's work is much in demand and comes fairly pricey—a four figure sum is not at all unusual for a model of this sort!

## NEXT MONTH

Biggest news for readers of this magazine is the commencement of a brand new series of features on model railway construction, briefly outlined in this issue. A second series of three articles also makes its appearance and describes the development of Tank Warfare. Apart from providing very interesting casual reading, the depicted photographs should prove useful to our Wargaming Fraternity.

From " Spanner " comes a long awaited descriptive feature on how Dinky Toys are made, which will prove of tremendous interest, especially to our younger readers.

Naturally, all the regular firm favourites are included in the line-up. " Stamps ", " Battle ", " Air News " plus the regular features on Meccano.

Keep an eye open for our spectacular and colourful " Dinky Toys " cover.


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# CONTENTS


**ON THE EDITOR'S DESK** 309
*News and Views by the Editor*

**UP AND DOWN THE CLIFFS** 310
*W. H. Owens describes Cliff Railways*

**MECCANO LATHE** 312
*A Working model Lathe from a Dutch Reader*

**CRAWLER TRANSPORTER** 315
*The world's largest land vehicle*

**BUILDING A MODEL RAILWAY** 316
*Introduction to a new series*

**DINKY TOY NEWS** 317
*The latest from Binns Road*

**ON TWO WHEELS** 318
*Test No. 9, the B.S.A. Bantam*

**THE STORY OF TELEVISION** 320
*Arthur Rigby traces the development of T.V.*

**EXPANDING MICROWAVE COMMUNICATIONS** 324
*A science feature by W. H. Owens*

**AMONG THE MODEL BUILDERS** 326
*Readers' Meccano ideas*

**BALLOONS THEN AND NOW** 328
*The uses of air inflated devices*

**A CASE FOR HOT AIR** 331
*An unusual Meccano model*

**MECCANO CONSTRUCTORS' GUIDE** 334
*Part 6—Movement on Rails*

**STAMPS** 338
*Exhibitions on Stamps*

**GREAT ENGINEERS** 339
*John Rennie*

**BOOK REVIEWS** 340
*Meccano Staff look at new publications*

**JETLINERS PRESERVE THE ANIMALS** 342
*Animal Transport, 1970 style*

**TRANSPORT SIMPLICITY** 344
*Three simple Meccano models*

**PORTOBELLO ROAD** 346
*A look at London's Street Markets*

**AIR NEWS** 348
*John W. R. Taylor on Aviation*

**BATTLE** 350
*Part XXVI—Morale*

**MILITARIA** 352
*A Military review by Charles Grant*

**HAVE YOU SEEN ?** 354
*The latest products reviewed*



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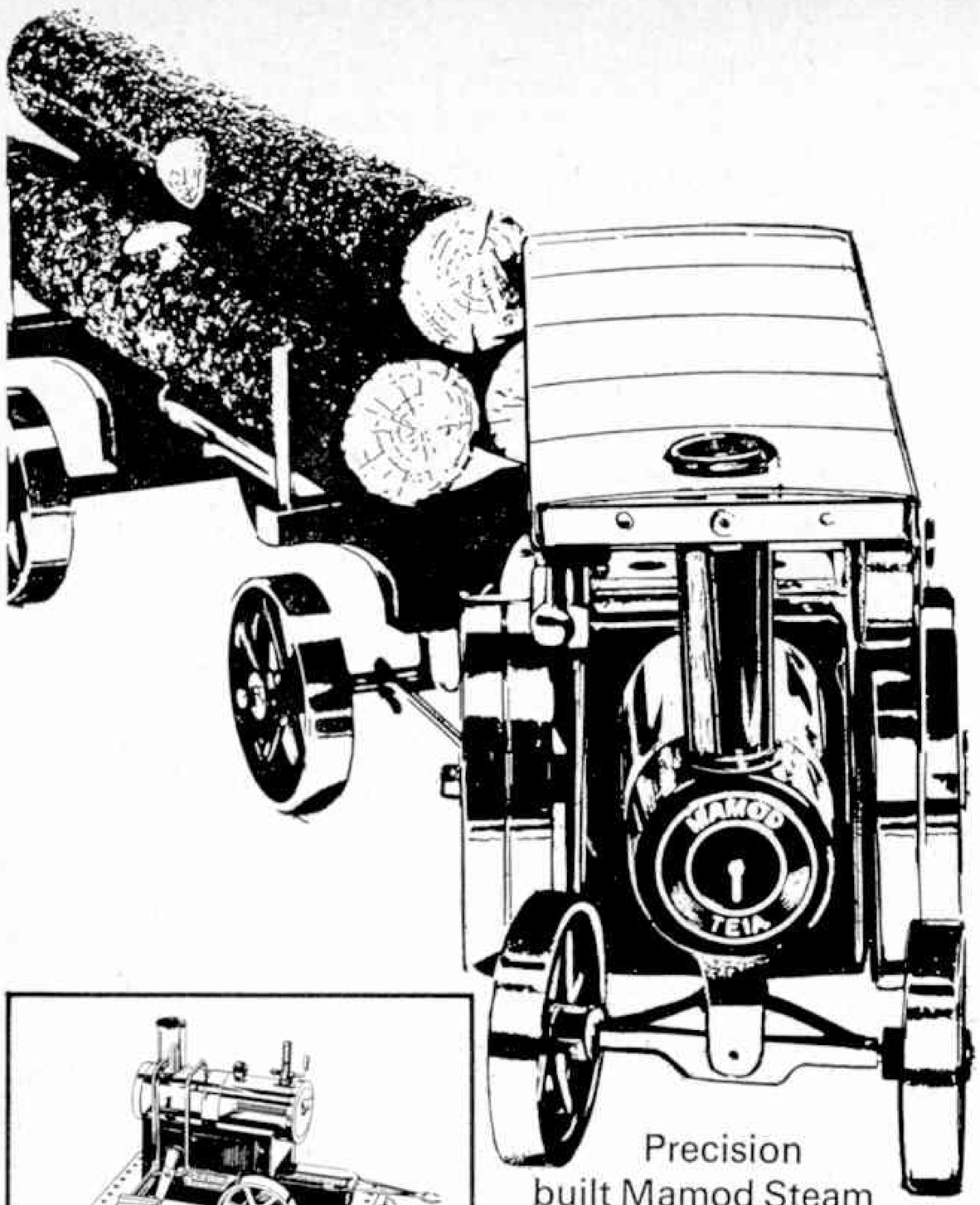


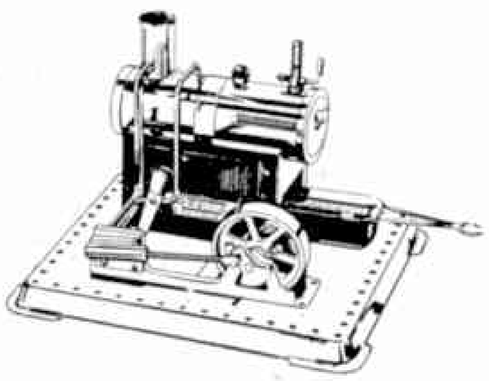

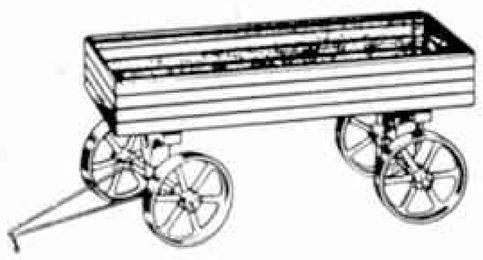

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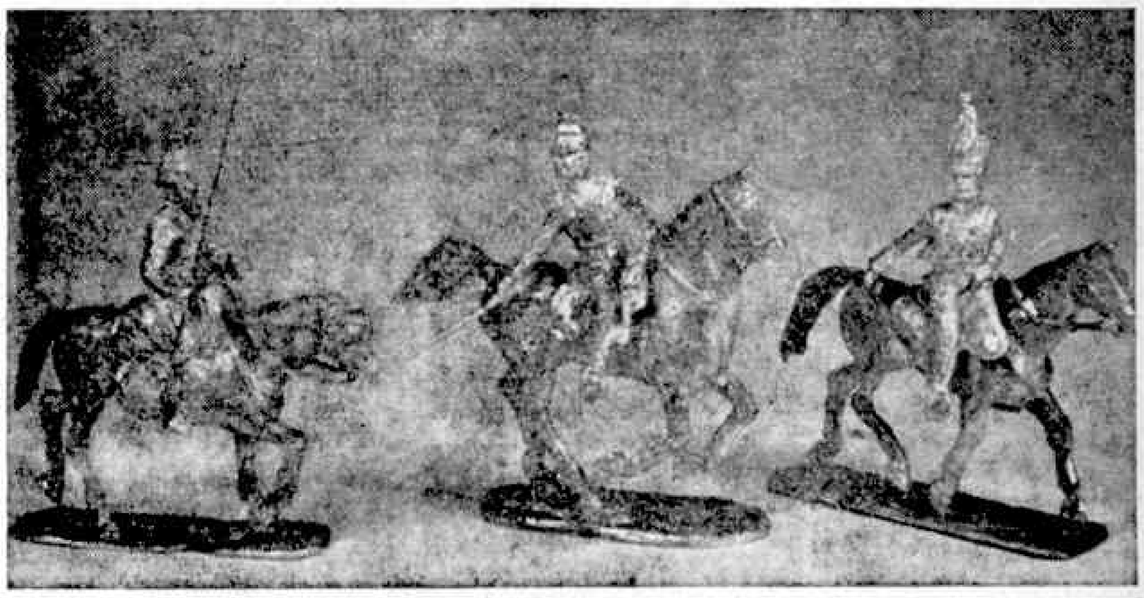

The '*Willie*' 30 mm. military figures reviewed and a constructive appraisal of the Tamiya 1/25th scale *Russian SU-100* for militarists. Auto men get the Chapparal 2H; Aero fans the *Sopwith 1½ Strutter* and *Baby* plus a Plastic Card *Martin Baker MB-5*, and Mariners will like the Hatteras Cruiser. Extensive reviews of new kits, accessories and useful books plus some fine surprise features complete the ninth issue with a wide variety.

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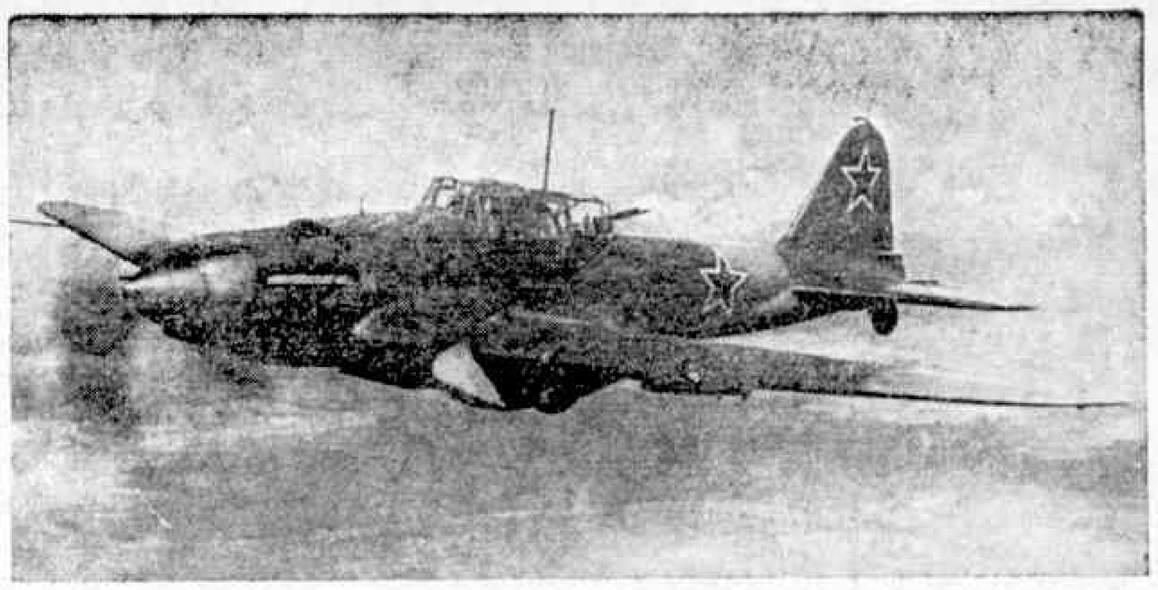

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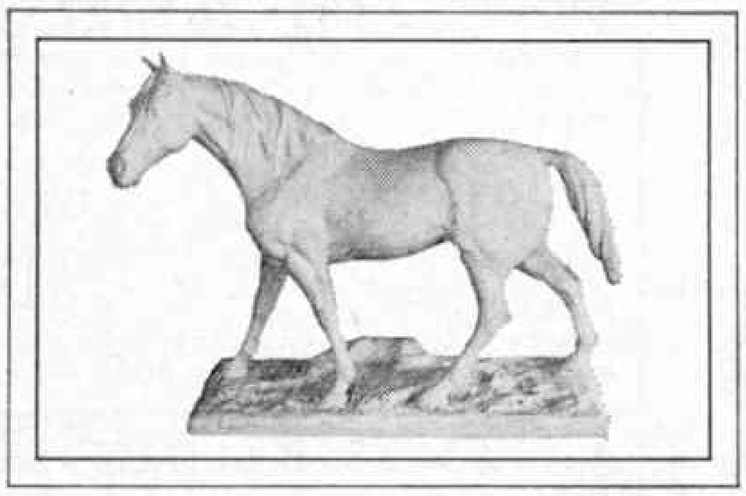



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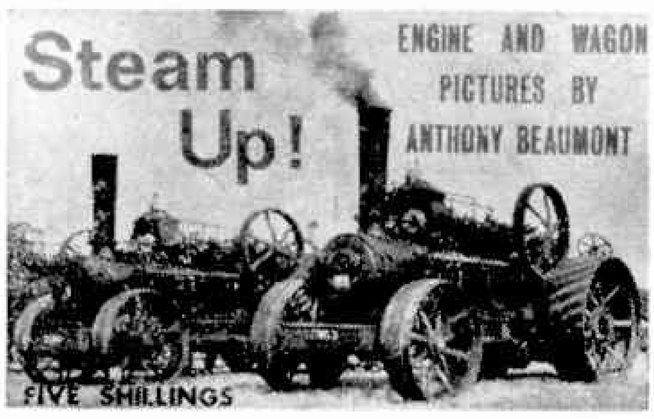
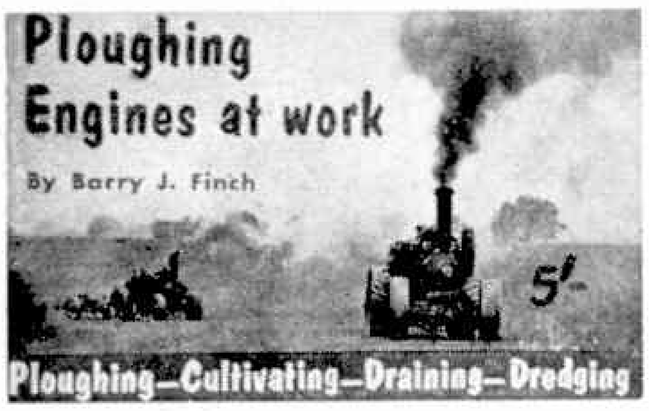



## 78 PLOUGHING ENGINES AT WORK

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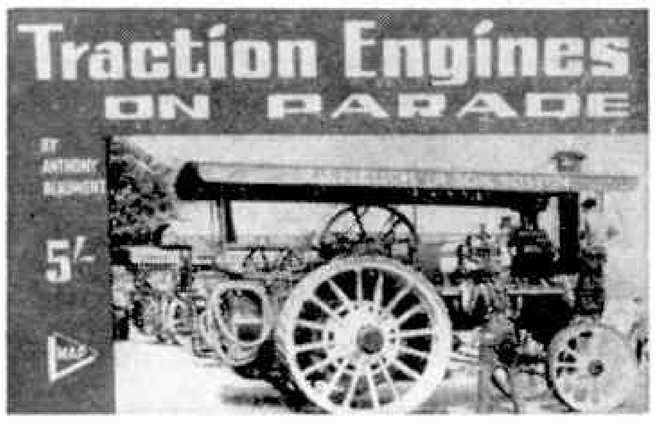


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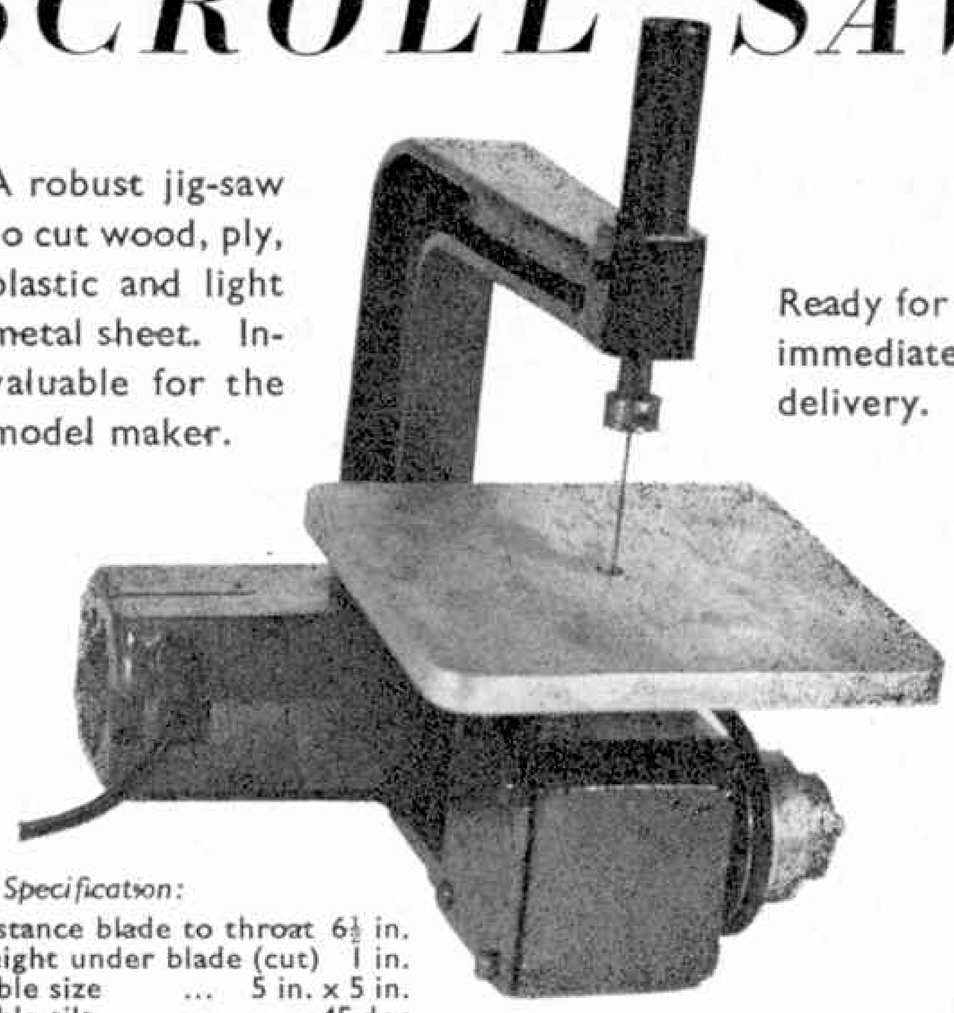

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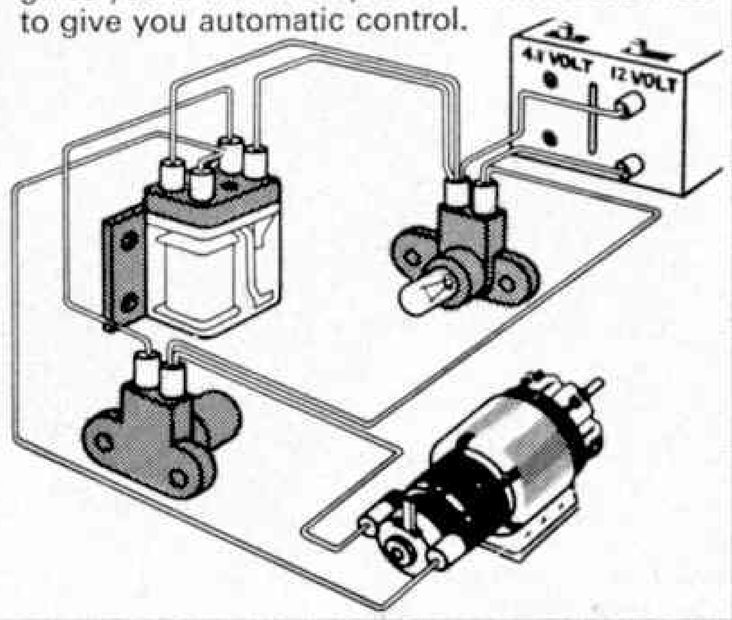


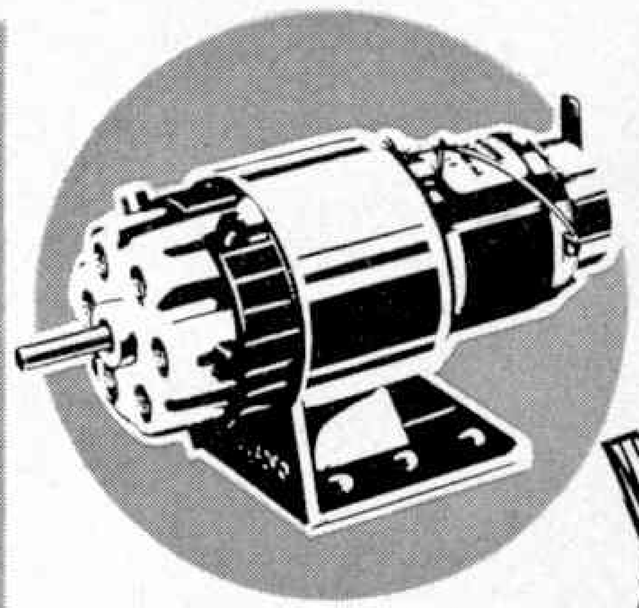

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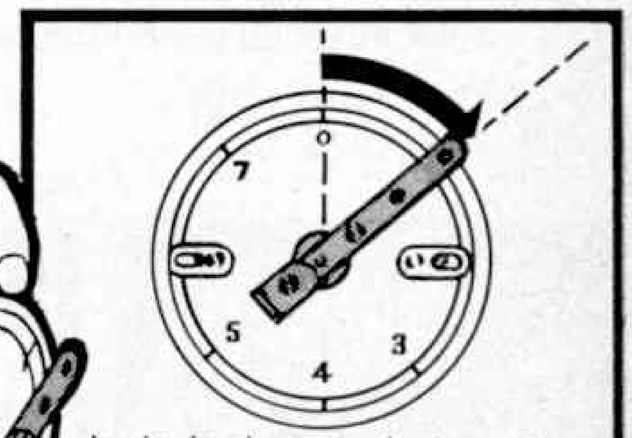
# Instructions for 66 BRAND NEW MODELS

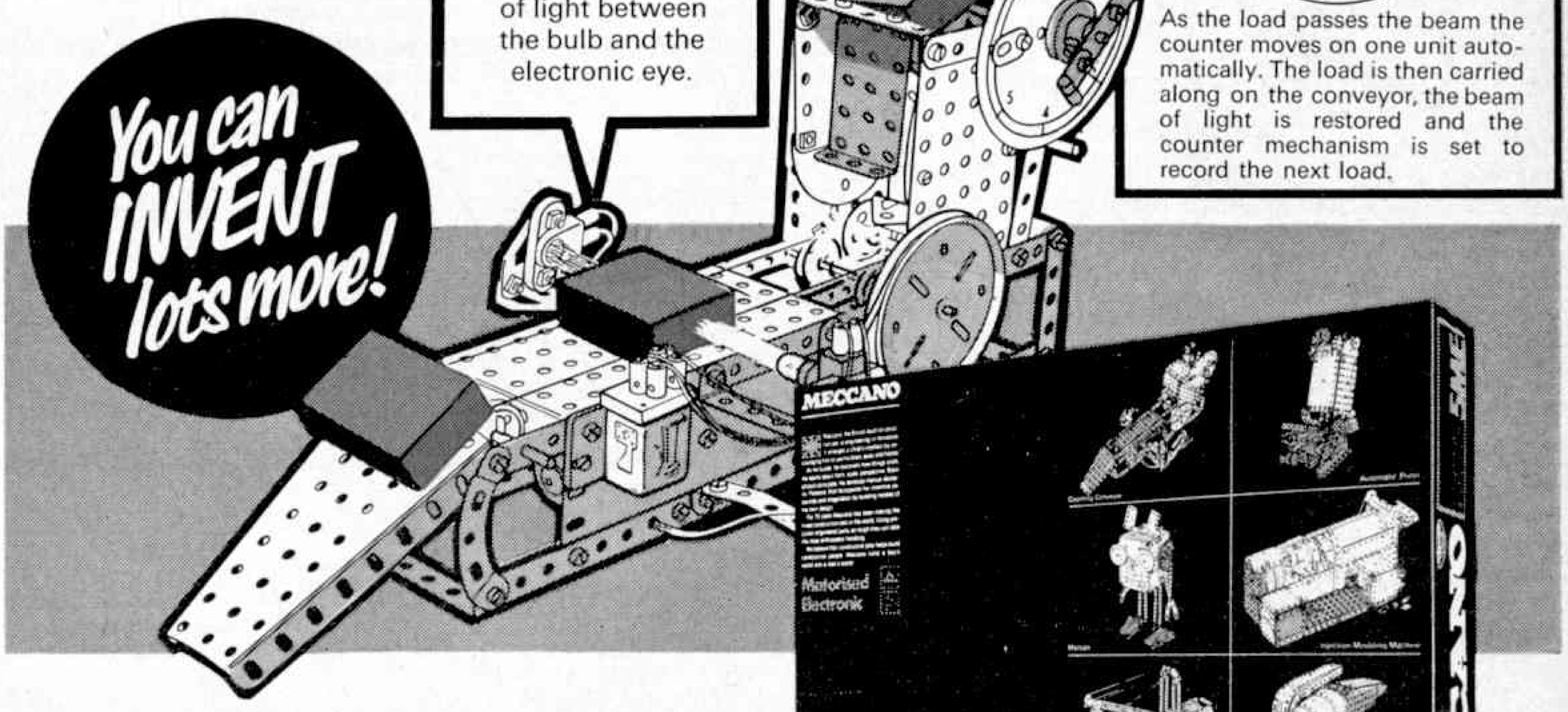
## including this Counting Conveyor

The load is dropped into the hopper by hand where it is automatically fed onto the motor-powered conveyor belt.

As the load is carried along the conveyor belt it interrupts the beam of light between the bulb and the electronic eye.



As the load passes the beam the counter moves on one unit automatically. The load is then carried along on the conveyor, the beam of light is restored and the counter mechanism is set to record the next load.




# MECCANO®

Every Set NEW—every model NEW

See NEW MECCANO at your toy shop now!

## Meccano Camera

Quite a large number of Meccano enthusiasts have constructed models of cameras over the years, but to the best of my knowledge never one that took pictures —until now that is.

An Italian Meccano builder and regular contributor to this magazine, Guiseppe Servetti, has designed, built and used a Meccano camera, and to prove it, below is one of the first photographs taken by this remarkable piece of constructional work.

**Shown above is Guiseppe Servetti with his incredible Meccano Camera and " Magic " Robot.**
**Below is the photograph taken by his camera and showing from left: Mr. H. J. Fallmann, Managing Director of Meccano/ Tri-ang Ltd. In the centre that Robot again ! On the right is Mr. D. J. Laidlaw-Dickson, Managing Director of M.A.P. Ltd.**

The camera itself is built from standard Meccano parts with the addition of a lens and flash equipment " borrowed " from a more conventional model.

The film used is " Polaroid " which is developed and printed automatically within 15 seconds of it being taken (see our review of the new Polaroid Camera below).

One final point: The robot seen in the photograph showing Mr. Servetti and his camera is a working one and performs a " vanishing trick " with Dinky Toys. Naturally enough Mr. Servetti built that too !

## Polaroid Camera

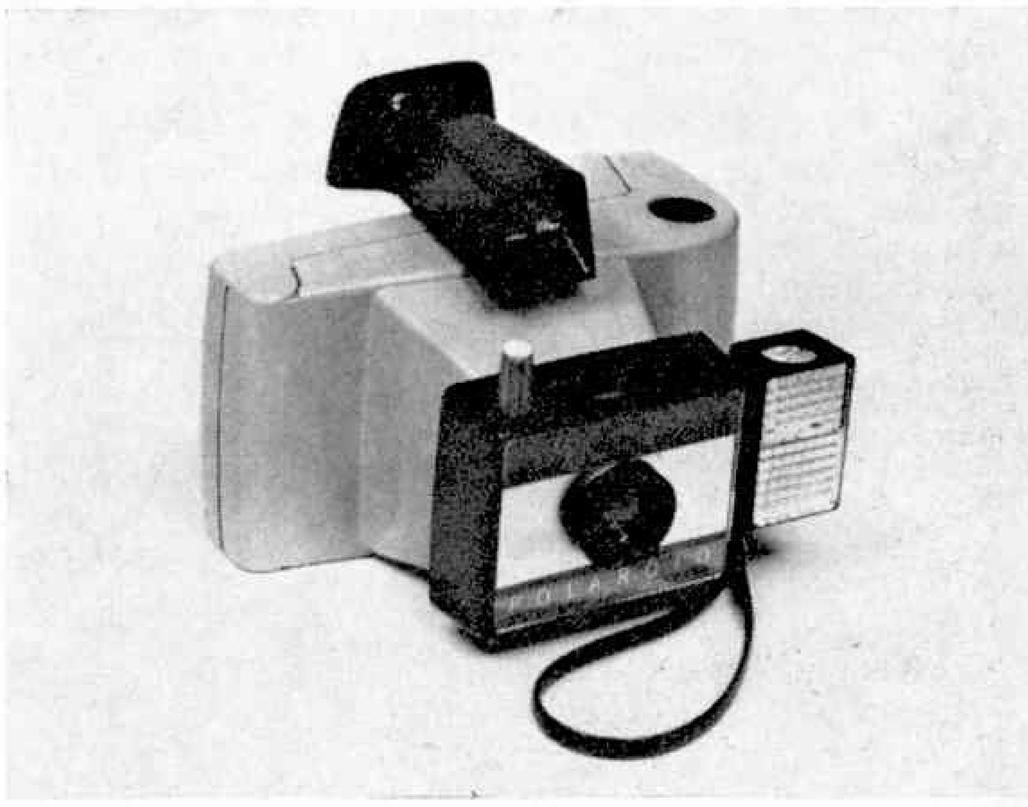
Interested to know more about the remarkable film Mr. Servetti used in his camera, I contacted Polaroid

# ON THE EDITOR'S DESK

U.K., who kindly sent along a sample of their latest camera and a few rolls of film for me to try for myself.

To be frank I know very little about photography and am baffled at the wonderful pictures some of my friends take with cameras which look terrifyingly complicated to my ignorant eyes ! It was for me very assuring to find that the new Polaroid Swinger 11 is just about as simple as a camera can be.

The secret of this " instant picture " system lies in the roll of negative film, which has attached to it the developer and positive printing paper. When a



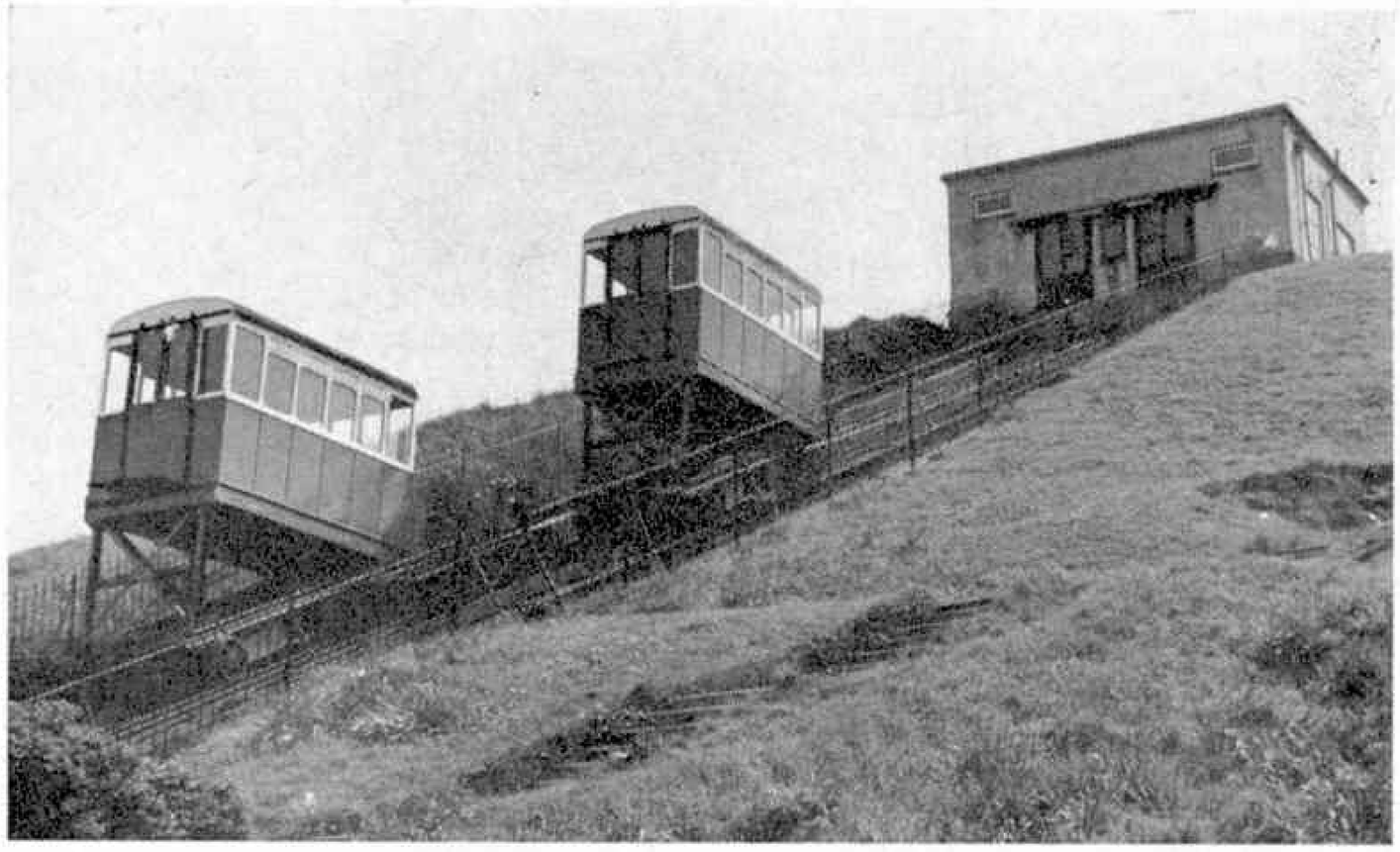

**The new Polaroid Swinger 11 Land Camera provides a finished photograph in seconds. The photograph shows it fitted with a " flash " unit which just pegs into the side.**

photograph has been taken, you pull the film out from a slot in the rear of the camera (which allows only one frame at a time to be withdrawn). The developer is contained in a small sack which is squashed as the combined negative and positive print is removed then the developer gets to work as you hold the film for 15 seconds in your hand. The negative can then be peeled from the positive and Hey Presto ! A complete picture.

The camera itself is very simple to use (even I managed it !). When you look through the viewfinder and gently squeeze the little red knob on top of the camera, a small red panel lights up with either the word " No " or the word " Yes " on it. Turn the knob until it reads " Yes ", press the button and a picture is taken. It's as simple as that.

The cost of the Swinger 11 is a mere £6.19.6, and the flash unit which just plugs into the side, only 14/11 more ! This one only takes black and white film (8 pictures on a roll and costing 17/3), but a colour/black and white version, the Polaroid Colour-pack 11, is available at £19.19.0.

**W. H. Owens looks at a very unusual method of transport in this feature entitled . . . .**



# UP AND DOWN THE CLIFFS

ALTHOUGH WE HAVE NOTHING on any comparable scale in Great Britain with the funicular railways of the European Alps, the cliff railways, or tracked lifts, in various coast towns provide some interesting and early examples of this near vertical form of passenger transport. Many of them are the best part of a century old, but with modernised equipment continue to carry very large numbers of passengers daily throughout the holiday season.

Like the pleasure pier and the promenade bandstand, the cliff railway was an innovation of the Victorian age when seaside holidays were established as a popular institution. The earliest installation of the kind—the 284 ft. long South Cliff Tramways at Scarborough—was opened in 1876. Another Scarborough lift—the Central Tramway (234 ft.)—was running four or five years later. Both of them are still in operation today together with two others—the North Bay Cliff Tramway and the St. Nicholas Cliff Lift—at the same Yorkshire coast resort. All these railways are now electrically operated on gradients of from 1 in 1.3 to 1 in 2.

The longest of all the cliff railways around England and Wales—and one of the oldest too—links the twin villages of Lynton and Lynmouth on the North Devon coast. Before it was opened in the summer of 1890, ponies and donkeys carried visitors between one and the other up or down a winding cliff path. The railway consists of narrow gauge $3\frac{3}{4}$ ft. twin tracks running a distance of 900 feet through the steep, thickly wooded slope at a gradient of 1 in $1\frac{3}{4}$.

A local engineer put forward the scheme for the Lynton-Lynmouth cliff railway, but it was due to the keen interest of Sir George Newnes, a well-known local resident, that the plans materialised. On his initiative a company was formed to carve the track through the cliff rocks. There was a good deal of opposition at the time from people who feared the beautiful stretch of coastline would be disfigured. In fact the scars healed quickly, and today the railway's walled in track has become part of the natural surroundings.

Most of Britain's cliff railways are electrically operated nowadays, but the Lynton-Lynmouth line is one which continues to work on the gravity water balance principle. The two cars are fixed equi-distant on the strong wire cables. Each carries a tank under the chassis platform which is filled by a pipelined supply from the West Lyn River to the top station at Lynton.

Before starting its descent, the upper car takes in extra water in order to hoist up the lower car which,

Our leading photograph shows the North Bay Cliff Tramway at Scarborough.

Above : The only surviving railway at Folkestone.

while waiting at Lynmouth station below, discharges water into the sea. At one point the closely positioned tracks part company to allow the cars room to pass each other. There was originally a halfway station here, where Lynton's North Walk crosses the line, but it was closed during alterations more than forty years ago. Extremely powerful hydraulic brakes, operated by the car conductor, are capable of stopping the cars dead in their tracks in the very unlikely event of a wire rope breaking. An unusual feature is the simple method of converting the railway for goods traffic by sliding either passenger car off its flat chassis platform.

The other Devon cliff railway is at Torquay, and connects the Babbacombe Downs with Oddicombe Beach 720 feet below. This is of more recent date, being opened in 1926. The cars, which can carry 20 passengers each, operate on two tracks of 1 in 2.84 gradient, and are attached to a cable made up of four 2½ in. diameter steel wire ropes. Power is provided by an electric motor system, the cars being operated by the attendant in charge of the Babbacombe Downs station where the motor switchgear is installed. Each car also has a special steel safety cable attached to it, so that should any failure occur on the main cable the car becomes automatically locked to the track.

Britain's only four-track cliff railway runs 180 feet up and down the famous wooded Leas above the seashore at Folkestone, Kent. The oldest of the two adjoining pairs of tracks is of 5 ft. 10 in. gauge and was opened in 1885—the first cliff lift ever to operate in the South of England. Five years later the Folkestone Lift Company built a second double track immediately adjacent to the first, so creating the unique four-track railway operated with two pairs of cars carrying 18 passengers each. Only in 1968 was the railway taken over by the local Council.

While the oldest of Folkestone's cliff railways continues to flourish, two other cliff lifts in this town—the Metropole Hotel Lift and the Sandgate Hill Railway—have both fallen into disuse. The Sandgate Hill Railway was specially interesting in that it had a varied instead of a continuous gradient—1 in 4.75 at either end and 1 in 7.04 in the middle section. This variation was necessary because the line ran above a road, and headroom for vehicles had to be allowed under the bridge.

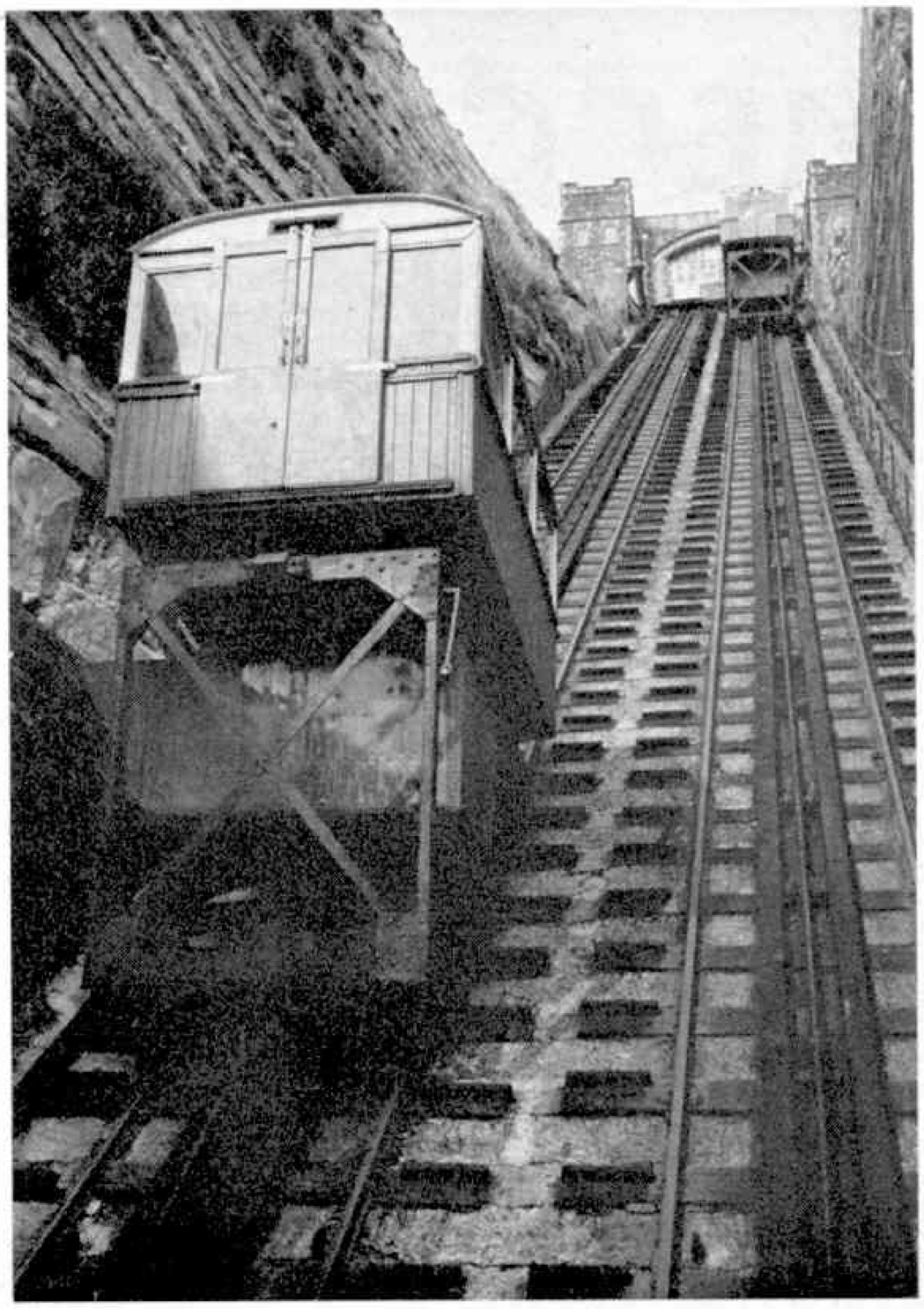
Hastings, in Sussex, has two cliff railways. The West Hill Lift—the older of the two dating from 1890—runs a distance of 500 feet at 1 in 3 from a sea-level terminus behind the Marine Parade up to the ancient hilltop Castle. For part of the way the two tracks tunnel through the steep hillside. This funicular is operated by diesel power. The East Hill Lift, beyond Hastings harbour, is shorter and much steeper—267 feet in length with a gradient of 1 in 1.28—and runs in an open cutting throughout.

Opened in 1903, the East Hill Lift is another example of a water balance cliff railway, each of the two 18-passenger cars carrying a 600-gallon water tank. In this case, however, the water discharged from the car at the bottom is electrically pumped to a large storage tank at the upper station where the tank of the car waiting there is filled.

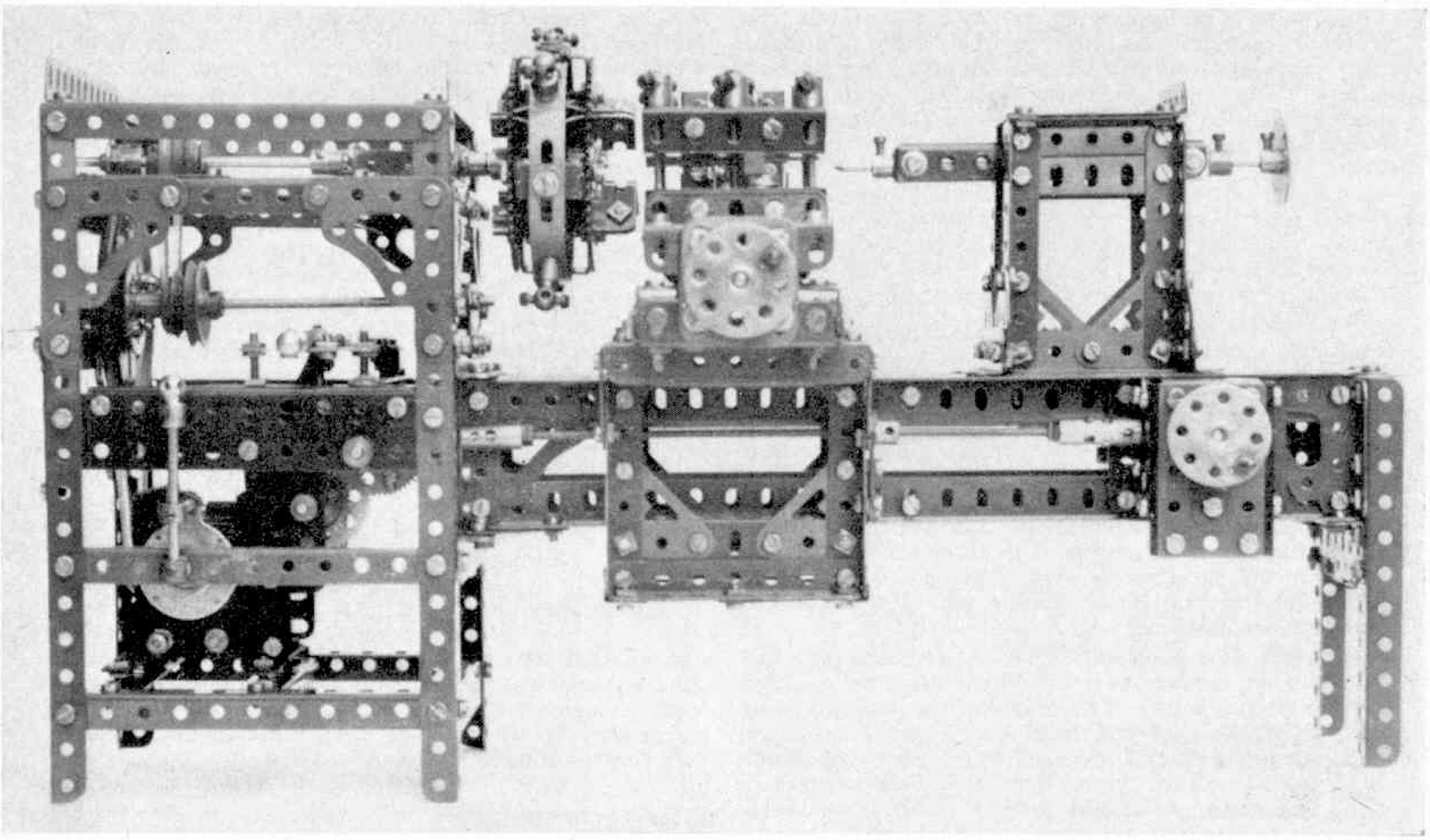
On the Welsh coastline, a 1 in 2 funicular runs up Aberystwyth's Constitution Hill, a grassy cliff rising to 500 feet above the foreshore at the northern end of the town. The construction of this line in 1895-96 was quite a formidable undertaking, chiefly because a vast quantity of faulty shale and rock with debris from a disused slate quarry had to be removed before the track could be laid. Even so, the task was completed and the railway opened within a year. For many years the Aberystwyth cliff was operated by water balance—the discharged water being returned to an upper reservoir by steam pumps—but eventually electricity was installed. Each of the steel cables is tested to 120 tons per square inch and the double cables combined are actually twenty times stronger than the full working load of passengers and cars.

The other cliff railway of Wales is of a rather different character from those which have been described so far. This is the Great Orme Railway at Llandudno, a cable tramway which climbs by more gradual stages from the town to the 679 ft. summit of the famous headland on the western side of Llandudno Bay. It has been carrying loads of holiday visitors to and from one of the most thrilling viewpoints around the Welsh coast for more than sixty years.

The Great Orme is in two sections. The lower section is 870 yards (roughly half a mile) long with a gradient averaging 1 in 6. The upper section is 827 yards long, on which the steepest gradient is about 1 in 10. Passengers change cars at the halfway stage between the two sections. These open-sided cars carry 48 passengers and take their power from overhead electric cables. Most exciting, of course, is the ride towards the summit where, in clear weather, a breath-taking panorama embraces the Snowdonia mountain peaks, Anglesey, the Isle of Man and even the distant mountains of the English Lake District and County Wicklow in Ireland.



**The East Hill lift at Hastings works on the water balance principle. The water tanks are clearly shown under the nearest car.**



# MECCANO LATHE PART I

## An advanced model built and described by Dutch Reader Dr. J. DE ZEEUW

AMONG METAL-WORKING MACHINES, the lathe is one of the oldest and, at the same time, one of the most interesting to use—a fact which applies equally to model metal-working machines. Meccano makes an ideal medium for a model lathe, but, because vibration is a serious drawback when working with relatively light material, a Meccano lathe requires a very rigid and sturdy construction. This can be achieved by reinforcing nearly all rectangular connections, making quite certain that the connections themselves are at 90 degrees exactly. Moreover, the sliding parts must be strictly parallel and the moving parts must be carefully adjusted, as all unnecessary play causes vibration and this, in its turn, causes inexact work.

The advanced modeller, who does not object to filing and re-shaping some standard parts, will not encounter many difficulties while assembling the lathe featured here, the construction of which is, in fact, rather simple. If the builder proceeds carefully, using only straight and undamaged Angle Girders for the sliding parts, and bearing in mind the above principal constructional requirements, the completed model will give satisfactory results when turning wood or a soft metal such as brass.

### Motor and Gear Casing

Construction of the lathe is started with its motor and gear casing. This part consists of four vertical $9\frac{1}{2}$ in. Angle Girders 1, connected, at the top, by four $5\frac{1}{2}$ in. Angle Girders and, in the third hole from the bottom, by three $5\frac{1}{2}$ in. Angle Girders, as shown. The two lateral Girders are connected by two transverse $5\frac{1}{2}$ in. Angle Girders 2 on which the Electric Motor will later be mounted.

Girders 1 are then further connected through their third holes down, by another four horizontal $5\frac{1}{2}$ in. Angle Girders, the side two of which are themselves joined by a $5\frac{1}{2}$ in. Angle Girder 3. Mounted in the centre of this Girder, and also in the centre of the two Girders on each side of it, are the three bearings 4 of the main shaft 5, these bearings consisting of a $1\frac{1}{2}$ in. Angle Girder and a Double Arm Crank bolted through the slotted holes. Both right-hand bearings are flanked by two other $1\frac{1}{2}$ in. Angle Girders bolted to the $5\frac{1}{2}$ in. Angle Girders to form a sturdy construction. Another similar bearing is bolted to a horizontal $5\frac{1}{2}$in. Angle Girder 6 fixed to the left-hand side of the casing. As is apparent from the illustrations the casing is reinforced by eight Corner Gussets.

Bolted between Girders 1 at each side is a $5\frac{1}{2}$ in. Flat Girder 7, to which a $4\frac{1}{2}$ in. Angle Girder 8 is fixed. Girders 8 then being connected by a $5\frac{1}{2}$ in. Strip 9 fixed through the second holes of the Girders. Mounted on a Pivot Bolt fixed in the fourth hole of Strip 9 is a Ball Crank 10, to one arm of which two

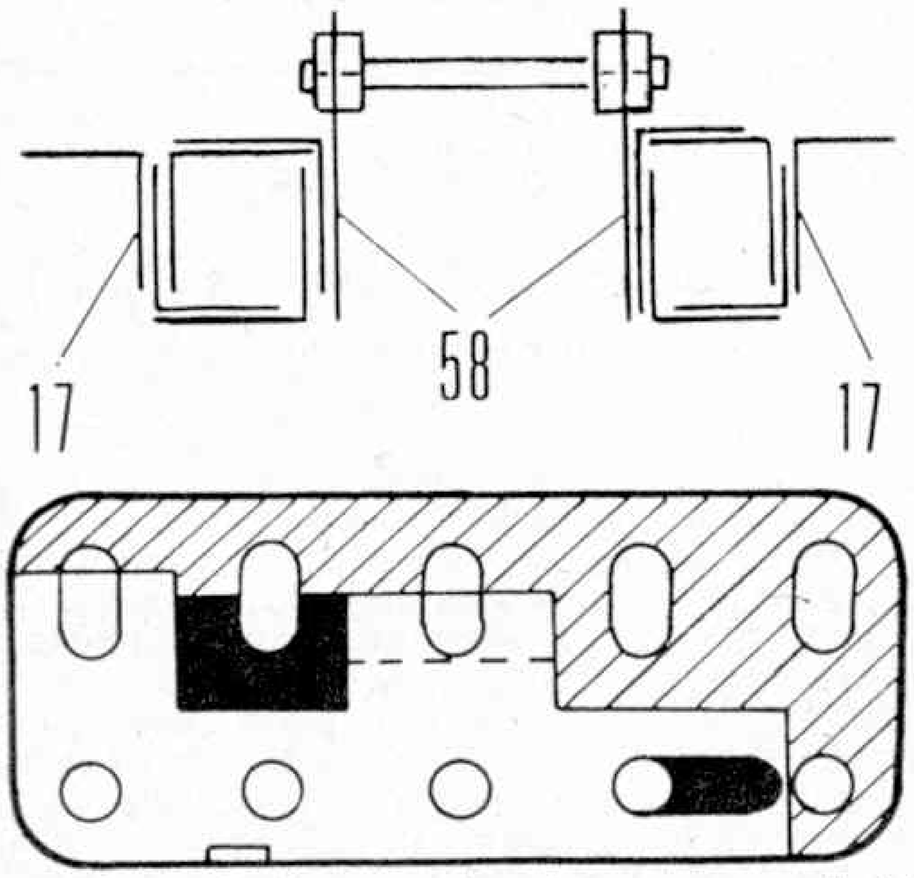
right-angled Rod and Strip Connectors are fixed. Held in these Rod and Strip Connectors is a 4 in. Axle Rod 12, serving as the stop/reverse lever of the motor-driven lead-screws 68, as will be later described. The Rod rests on a 2 in. Strip 13 that is fixed to Front Angle Girder 8 by means of two inverted ¾ in. Bolts. Two additional $\frac{7}{32}$ in. Bolts are fixed in the remaining holes of this Strip, as shown, a Tension Spring 14 preventing the Rod from slipping over the Bolts when it is set in position. A 5½ in. Angle Girder 15 carries the motor control lever, supplied by a 2½ in. Axle rod fixed in a Collar 16, connected to Girder 15 by means of a Bolt. Later, when the Motor is placed into the casing, the motor lever is fixed to a 2 in. Screwed Rod which is locked by a Nut in the bore of a Collar, fixed on the motor reversing lever 16.

## The Lathe Bed

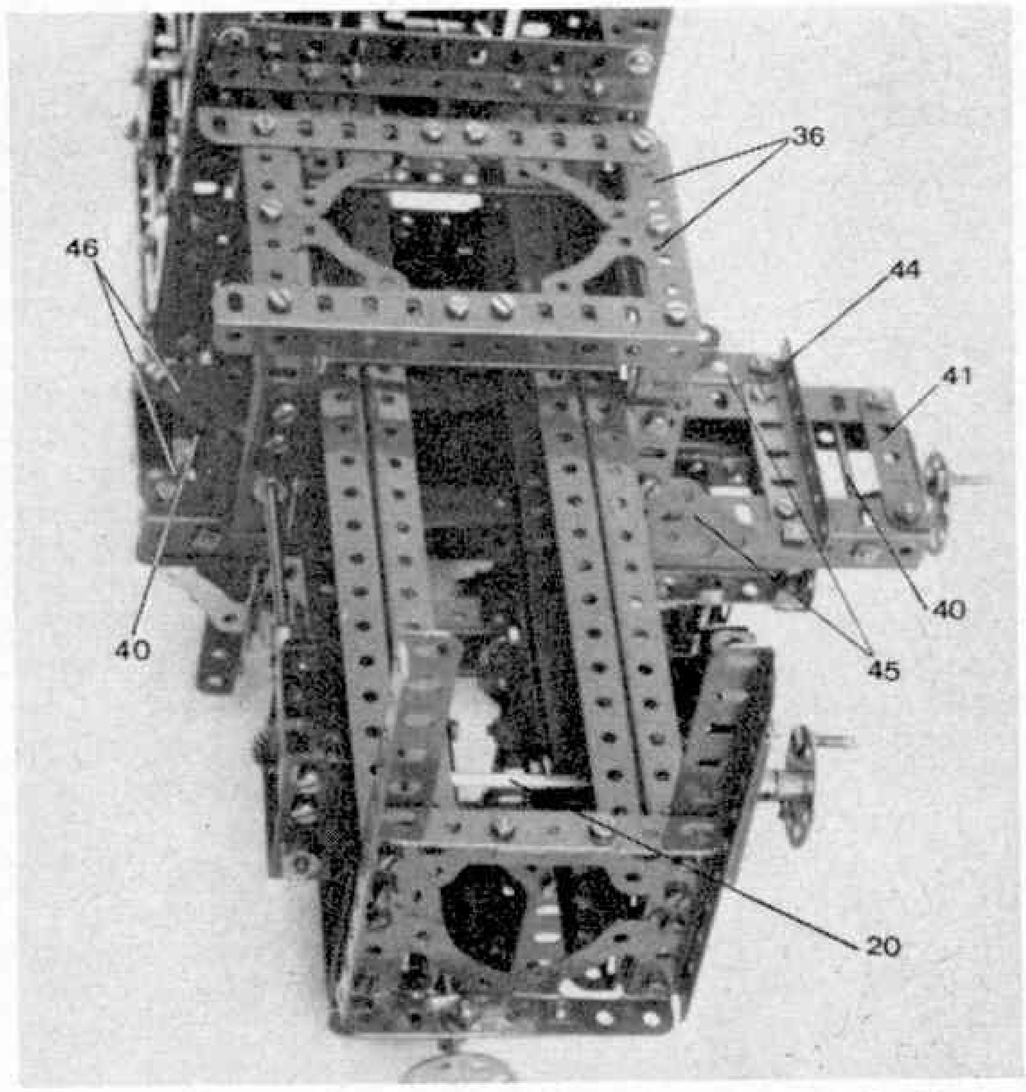
Coming to the lathe bed, this consists of four specially-prepared compound angle girders, the upper girders being made up of a pair of compound girders 17, each supplied by three 12½ in. Angle Girders, arranged to form a compound T and E Girder (Diagram 1). The lower slotted side of the E Girder is inserted between those sides of the other two Girders which form the T 'leg'. The two E sides of the compound Girders are facing each other and form the guides along which the loose headstock slides.

Each of the two lower compound girders 18 consists of two 12½ in. Angle Girders that form an inverted T profile. The outer sides of the four T girders are the guides along which the lathe saddle will slide. The upper and lower compound girders are connected at each end by a 2 in. Angle Girder and a Corner Gusset 19, one of the securing Bolts in the case of one of the Corner Gussets at each side helping to fix a 2 in. Strip between the two girders, five holes in from the leg end. The lower end of this Strip is spaced from the lower compound girder by Washers. Journalled in the 2 in. Strips at each side is an Axle Rod 20, carrying Bush Wheel 21.

At this stage, the two outside legs of the bed are assembled before fitting, these being built up from two 5½ Angle Girders 22 bolted to four Flanged Brackets 23, the flanges of which are overlapped




Upper, Diagram 1: A cross-section of upper compound girders 17 and the sliding parts—with Flat Girder 58—of the loose stock-head. Bolts and Nuts are omitted.
Lower, Diagram 2, showing the way in which the side parts of the jaws are filed and sawn. The small upper black part is filed on a slant.




**This picture shows construction of the main bed of the Lathe. It is important to ensure that the framework is perfectly rigid and that all angles are exactly 90 degrees.**

three holes. Bolted between the fifth hole from the top of the legs is a 3½ in. Angle Girder 24, the second and sixth holes of which must be elongated somewhat, in the direction of the third and fifth holes respectively, by means of a round file, and in these slotted holes the ends of the inner lower bed girders are bolted. Two holes of two 5½ in. Angle Girders 25 are also filed in the same way, the holes here being the fourth and eighth holes, which should be enlarged in the direction of the fifth and seventh holes respectively. Girders 25 are to be fixed at the upper and lower inside ends of the bed.

The legs are now bolted to the bed and, after this is done, great care should be taken to ensure that the compound girders are perfectly parallel, preferably by means of a slide gauge (which may be made of Meccano parts if not at hand). The bed is then bolted to the motor casing along with Angle Girders 25. In the centre of upper Girder 25, a 1½ in. Flat Girder is fixed with its elongated holes upward. In these holes a Double Arm Crank is bolted to serve as one of the bearings of Axle Rod 26. *The angle between bed and casing should be exactly 90°.*

## The Chuck

An important part of any lathe is the "chuck" which holds the material to be turned. In the model, the chuck is a four-independant-jaw example, the material for turning being centred by the centre point of the main shaft 5 which protrudes about $\frac{5}{32}$ in. through the boss of the 3 in. Sprocket Wheel serving as the front plate of the chuck. General construction of the chuck is apparent from the appropriate accompanying photograph, from which it can be seen that a little "doctoring" of parts is necessary here.

Two 3 in. Sprocket Wheels are each provided with four slots, using a round file, the sprockets first being mounted on a common Rod, bolted together and clamped in a vice. The length of each slot should be 1 in., its width being equivalent to the diameter of a hole.

Each of the four jaws is made of two 2½ in. Flat Girders 28 re-shaped as is shown in Diagram 2. The black parts must be filed off; the hatched parts can be sawn off, and to ensure that the modifications are identical on all four Girders, they should be carefully bolted together and filed and sawn as one unit. Approximately ¼ in. is next cut off each of four Cores for Cylindrical Coils (electrical Part No. 528) the Cores then being provided with two threaded transverse bores by means of a $\frac{5}{32}$ in. tap the distance between the centres of these bores being $\frac{7}{16}$ in. When this has been done, the cores are tightly clamped between two of the re-shaped Flat Girders 28, to form the side parts of each jaw, by means of four Grub Screws 29 and Washers bolted in the transverse bores of the Cores. The central or lower Grub Screws are bevelled by filing in order to prevent blocking of the jaws when these are screwed to the centre. It will be seen from the accompanying photograph that each pair of re-shaped Flat Girders is bent round the respective Cores. The correct shape is obtained by forming the Girders round the Cores, using Nuts and Bolts to apply force, first inserting a Washer between the Girders on each of the Bolts. Both ends of a jaw must be in a direct line with each other, so some re-bending with pliers will be necessary in most cases. After this is done, the bolts used for bending are removed.

If a tap is not at hand to thread the Core, as mentioned above, an alternative although less rigid method of construction is to file two slots in the Cores, in which Flat Girders 28 are inserted. The slots should, of course, be filed very carefully to keep "play" to an absolute minimum and, if this method is used, the centre of each Girder 28 should be sawn off as indicated by the dotted line in Diagram 2.

If one thinks slotting of the two 3 in. Sprocket Wheels tiresome, two 3½ in. Slotted Gear Wheels may be used, the size of which is however somewhat less suitable, and the construction a little less sturdy.

Next, four 3½ in. Strips 30 are bent as shown to form double brackets, this again being done very carefully to ensure that all four are identical. If this is not the case, the Chuck will swing on its shaft. The length of each double bracket lug is $\frac{15}{16}$ in., the centre hole of the Strip of course serving as the centre point of the bracket.

A 4-hole Collar 31 (electrical Part No. 140Y) is now "doctored" by drilling out the threads of the transverse bores with a $\frac{5}{32}$ in. drill. This Collar will serve as the central support for four 2 in. Screwed Rods 33 which will be screwed into the longitudinal bores of Cores 27.

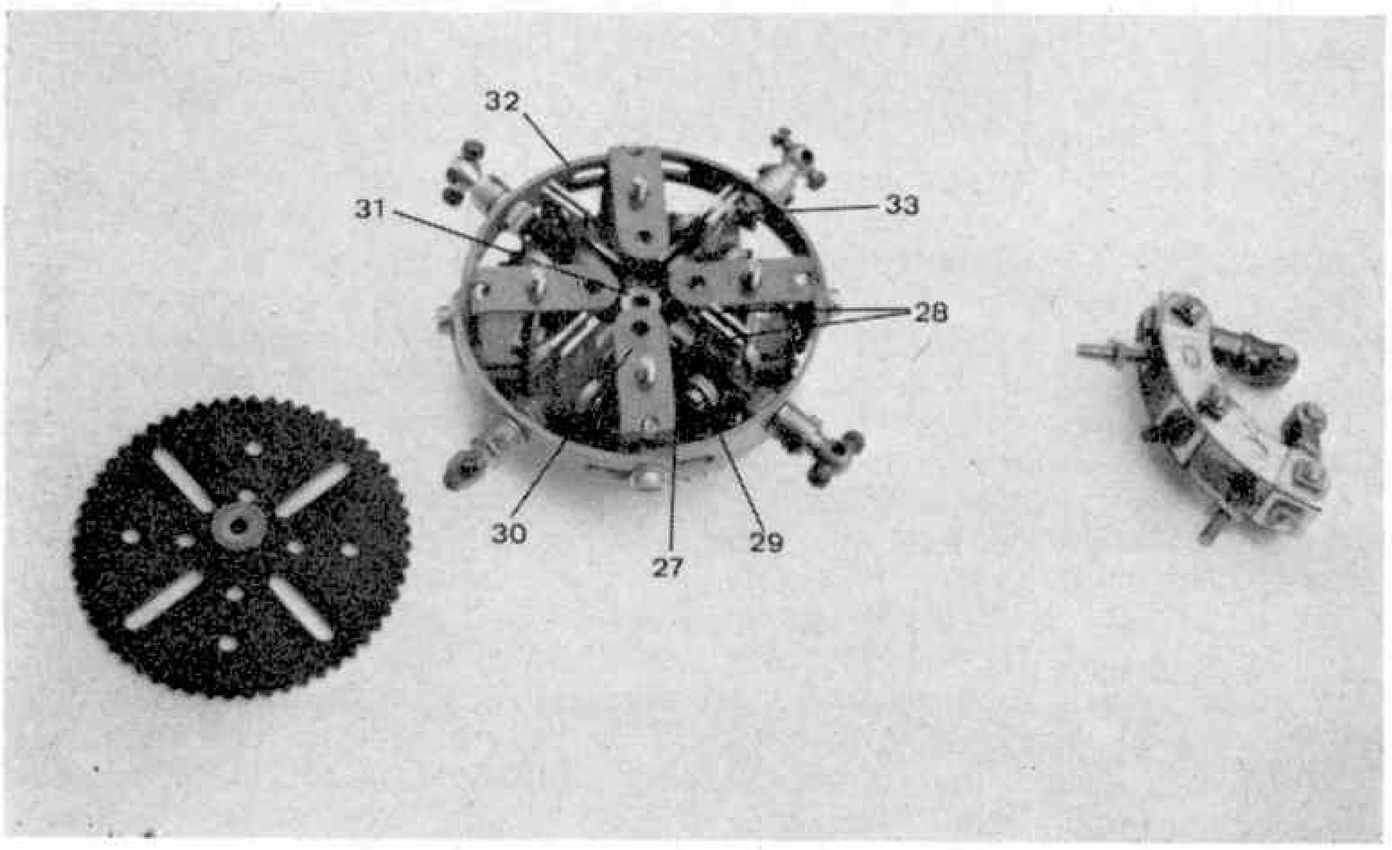
Now the chuck can be assembled. First double brackets 30 are fixed to one of the two slotted Sprocket Wheels, mounted boss inwards, using four standard Bolts in the inner round holes and four 2 in. Screwed Rods, shortened by ½ in. in the outer round holes. The Rods, however, may be replaced by suitable commercial bolts, as in fact, is the case with the model shown. The four jaws are then inserted in the slots of the Sprocket, after which Screwed Rods 33 are screwed through the longitudinal bores of Cores 27 and into a 4-hole Collar 31. A 2½ in. Rod is used temporarily for centring this Collar, the Rod being mounted in the boss of the slotted Sprocket Wheel after suitable spacing Washers have been added.

**PARTS REQUIRED**

| | | |
|---|---|---|
| 1—2 | 2—27a | 1—103d |
| 1—5 | 4—30 | 14—103f |
| 2—6 | 2—30a | 4—103g |
| 10—8 | 2—30b | 9—103h |
| 8—8a | 2—31 | 18—108 |
| 22—9 | 1—32 | 10—111 |
| 4—9a | 285—37a | 7—111a |
| 23—9b | 375—37b | 8—111c |
| 25—9d | 34—38 | 4—115 |
| 8—9e | 1—38d | 1—115a |
| 9—9f | 1—51 | 2—116 |
| 2—11 | 18—59 | 2—116a |
| 1—13a | 5—62 | 2—123 |
| 2—14 | 2—62a | 6—126a |
| 2—14a | 6—62b | 1—128 |
| 1—15a | 2—63 | 14—133 |
| 2—15b | 4—63c | 4—133a |
| 1—16b | 6—64 | 6—136a |
| 1—17 | 2—72 | 2—139 |
| 2—18a | 3—79 | 2—139a |
| 2—18b | 4—80b | 1—140y |
| 1—19b | 8—80c | 1—147b |
| 1—23a | 11—81 | 1—179 |
| 4—24 | 2—90a | 2—212a |
| 1—26b | 2—95b | 9—215 |
| 3—26c | 2—103 | 4—522 |

1—E.15R Electric Motor.
1—Eclipse Tool.
Suitable Drive-belting.

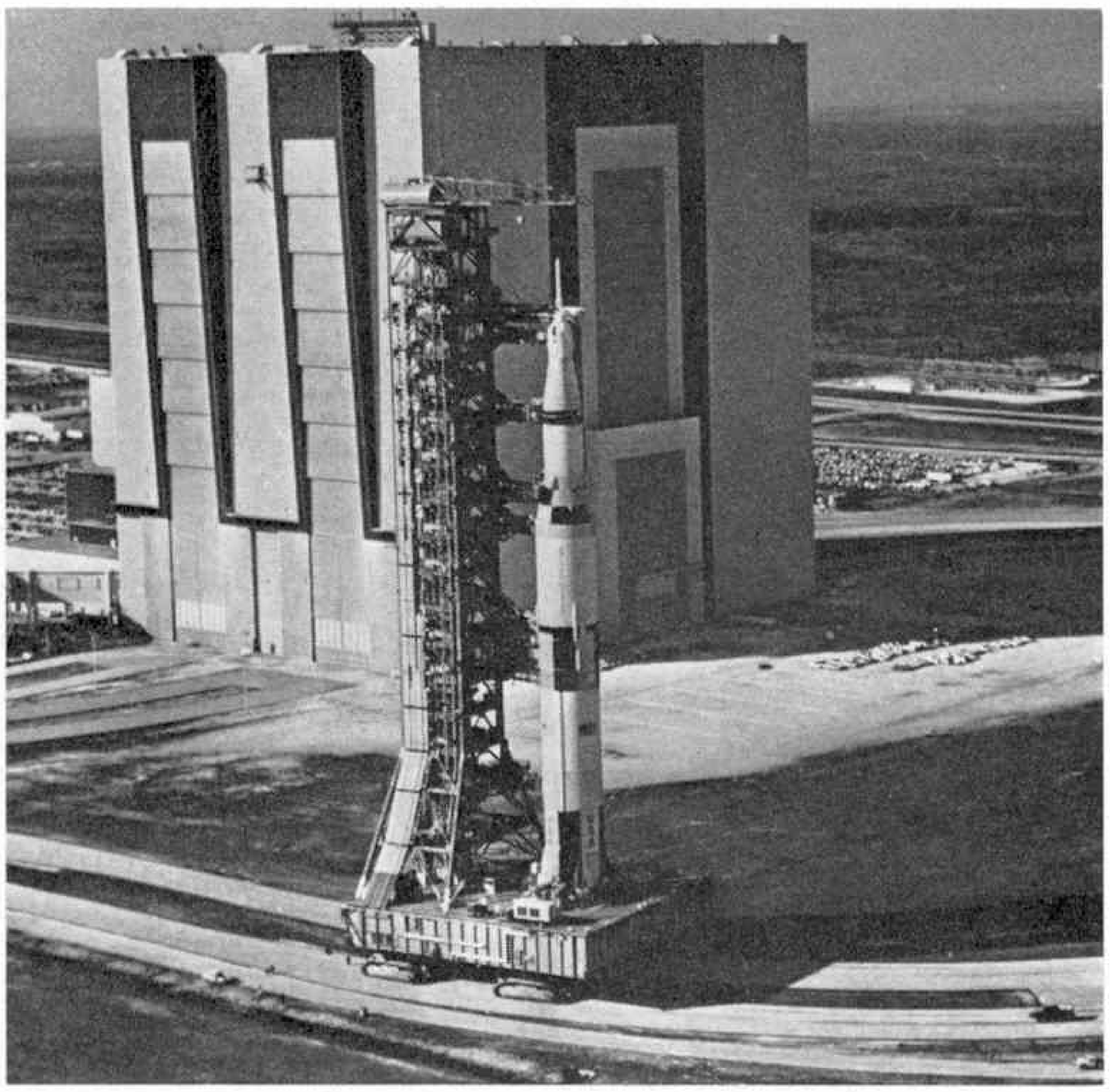
*To be continued*




The chuck, partly dismantled to show construction of the jaws.

# LARGEST VEHICLE IN THE WORLD

T. Holloway



THE ROYAL AUTOMOBILE CLUB'S Diamond Jubilee Trophy is the world's most coveted automatic transport honour. It has only been awarded three times since 1957, although nominations are invited each year from automobile clubs all over the world. In 1958 it went to Sir Vivian Fuchs, his Chief Engineer, David Pratt, and their ten companions on the Trans-Antarctic Expedition. Then, in 1962, it was awarded to Christopher Cockerell, inventor of the hovercraft. The third and latest award has been made to the National Aeronautics and Space Administration; Donald D. Buchanan, Chief of Engineering at the John F. Kennedy Space Centre; and the Marion Power Shovel Company, " for the design, development and construction of the crawler-transporter, which provides mobility to the space vehicle structures required by the Apollo Lunar Landing programme, an outstanding contribution in the field of automotive transport."

The only machines of their kind in the world, they are 131 ft. long, 114 ft. wide and each weighs about six million pounds. Chassis height is adjustable by hydraulic jacks from 20 ft. to 26 ft. They move on four double-tracked trucks, each 10 ft. high and 40 ft. long. Each shoe of the crawler belt weighs about a ton. There are 57 shoes per belt and eight belts per transporter. Propulsive power is provided by two main-drive diesel engines, each of 2,750 h.p. Fully loaded, a transporter has a speed of one mile per hour, unloaded two miles per hour.

They routinely carry 12.6 million pounds weight from the vehicle assembly building to the launch pads. A special ' crawlerway ', the equivalent in width to an eight-lane highway, had to be built for the transporters. It has an 8 ft. thick road bed so as to bear the combined weight of transporter, launcher and launch vehicle, something around 18.5 million pounds. The cost of the two transporters now in use was about 15 million dollars and they burn about 150 gallons of diesel oil per mile.

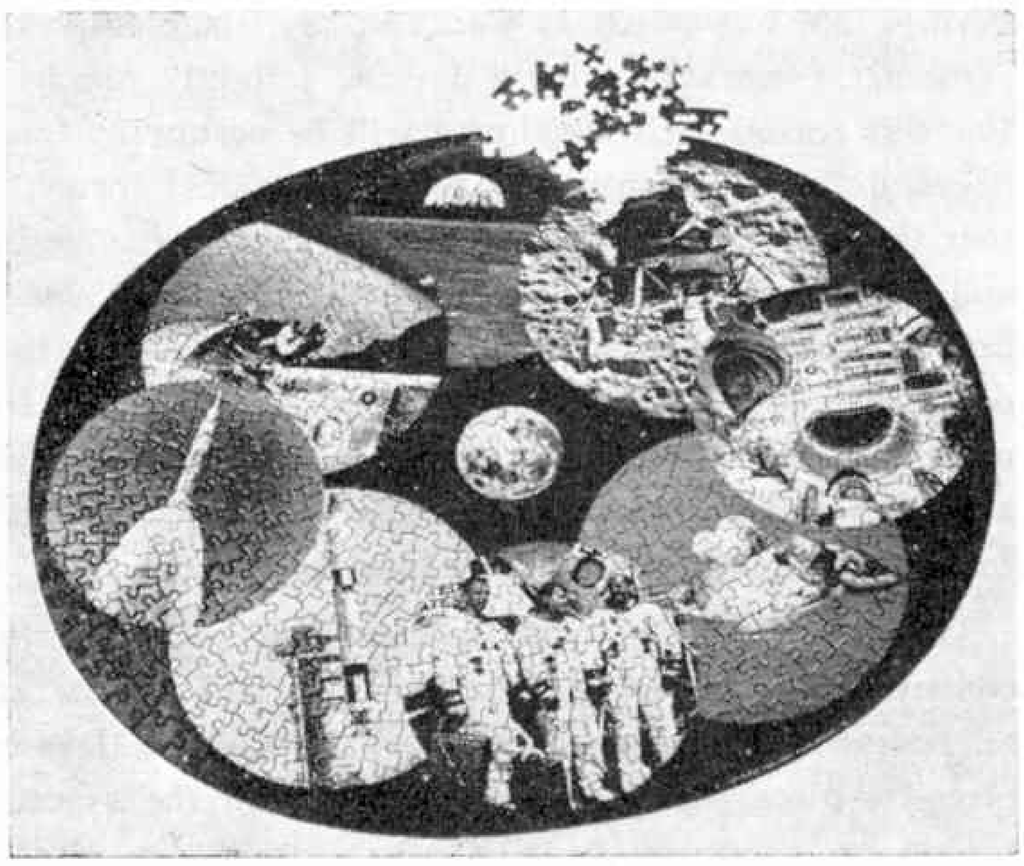
# NEW ' SPACE-AGE ' JIGSAW

**Tying in nicely with the " Space " theme comes this new jigsaw entitled " Moon probe " from Waddingtons, makers of " Monopoly ".**

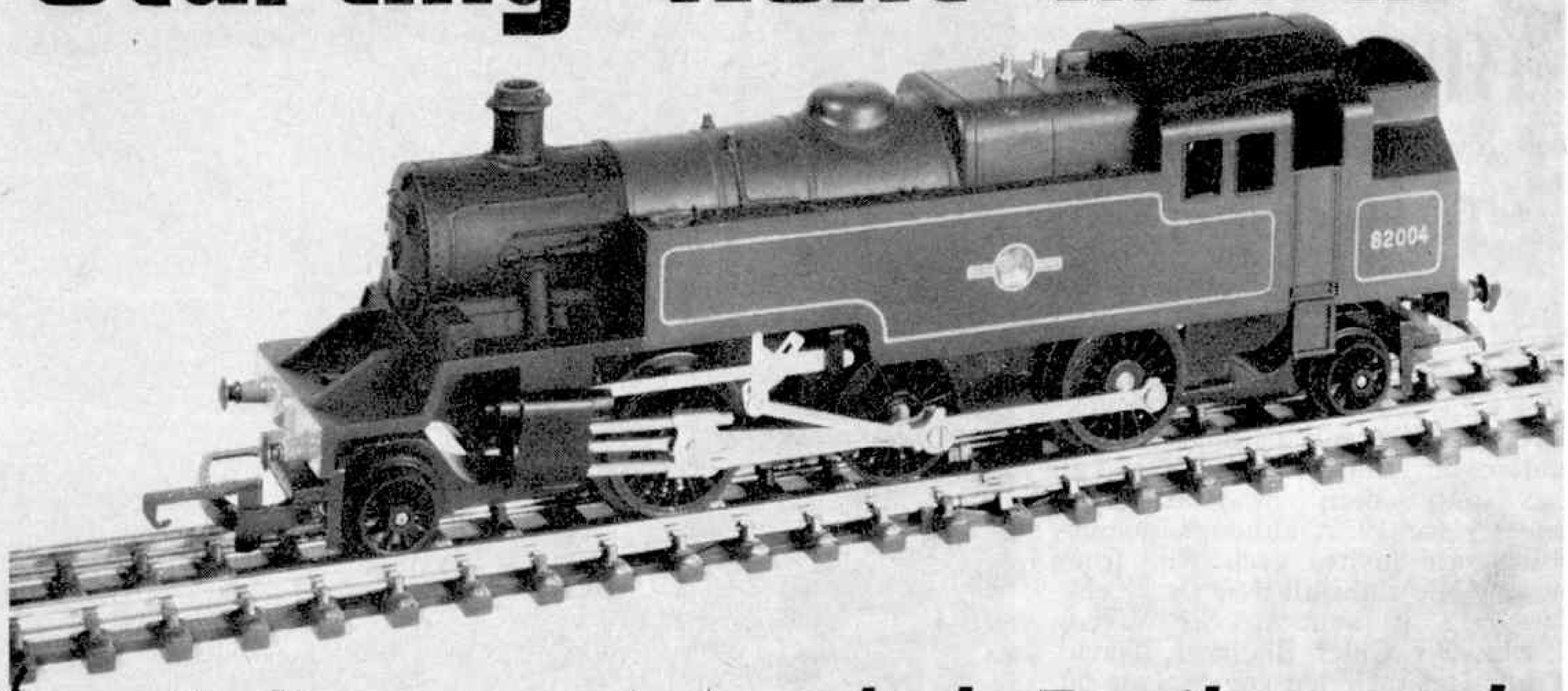
**It's a rather unusual jigsaw in two ways; it's elliptical in shape and contains no less than nine separate pictures, all of which are from actual photographs, taken on the Apollo missions.**

**With over 6,000 pieces, and measuring over 2 ft. in width it naturally takes many hours (it took us over ten!) to complete, and largely due to its shape and the masses of star sprinkled background, needs a fair amount of patience. For the jigsaw puzzle or space enthusiast a real challenge and certainly good value at 15/-.**

**Manufacturer: Waddingtons Ltd.**



# Starting Next Month




## 'Building a Model Railway'

STARTING NEXT MONTH in *Meccano Magazine* is the first of a brand new three part series aimed at readers interested in constructing a model railway layout. Entitled "Building a Model Railway," the series will be unique in many respects and will, we feel, prove to be of invaluable help, especially to beginners.

To start with, it will run for only three instalments, as it is generally felt that a longer series can become boring. No one wants to wait for, say, six months to construct a working railway layout, certainly not us! For this reason each instalment will be occupying four pages, and will be split into equal parts, this ensuring that the same amount of work is tackled each month, and there will be enough to keep constructors busy between instalments. A further point concerns the place each instalment will occupy on the contents. In order that each instalment can be easily removed and kept for possible future reference, the series will be found each month on the centre four pages.

We believe readers will welcome our new step in constructional feature presentation. It will not be at all necessary to follow the construction of our layout piece-for-piece. We will be explaining all the aspects of choosing a layout design, wiring it up, designing scenic effects and selecting rolling stock on a general scale. The first choice in all matters is left to you. You set your own budget and choose which way *you* wish to approach the job.

Our layout is being constructed purely to illustrate the feature (we have plenty of sketches and photographs in mind) and detail any "tricky bits" that may be encountered.

Naturally we have called in various experts in the model railway field to assist us in this venture. The engineers and staff at *Tri-ang/Hornby* are supplying us with the necessary items for construction and dealing out advice when needed. Our sister magazine, "*Model Railway News*" is lending its knowledge to the project, and whilst the series runs will welcome letters from *Meccano Mag'* readers who may need advice on any problems they encounter.

That just about sums up our introduction to the series. Next month sees the first instalment which will deal with the Hornby "Track-packs"; Track designs; baseboard selection and finally track laying. Meanwhile, how about digging out that old track and rolling stock, ready to make a start?

# DINKY TOY NEWS *from* *Alan Jones*

THRILLS, SPEED, EXCITEMENT and an element of danger could aptly describe one of the fastest growing sports of modern times—Motor Rallying. More and more people, these days, have fallen for the lure of competition driving and, as the interest in rallying has grown, so the appearance of specially-prepared " rally cars " has increased. Such cars, of course, are basically standard production models from well-known manufacturers, but with their own particular alterations; usually a battery of spotlamps, a sporty colour-scheme and a liberal sprinkling of competition numbers !

There is nothing in Rallying, generally, to dictate what type and make of car should be used and, in fact, most British models turn up from time to time. It is only to be expected, however, that some of them achieve greater popularity than others, and one such car which I believe is destined to lead the field in this direction is the dynamic Ford Capri. Meccano Tri-ang in Liverpool certainly think so, anyway, having just released their Dinky Toy Capri in a new and tremendously appealing rally finish, as Dinky Toy No. 213 Ford Capri Rally Car.

Based on the existing and highly successful Capri model, the new release has all the original's action features—opening doors, windows, seats, with tipping backs to those in the front, and a steering wheel, as well as sculptured sports wheels, authentic moulded ventilation outlets, number plates and jewelled headlamps. In addition to all these, however, the Rally Car has its own individualistic features including a brand new and extremely attractive colour scheme of deep-flamboyant red body, matt black bonnet and rear panel to capture that " sporty " look. Mounted in front of the radiator grill is a triple spotlamp assembly, the " sporty " look being further increased by plated racing-type rear view mirrors on the wings and the black competition number " 20 " on both the doors and bonnet. All in all, a " must " for the competition minded collector.

**For Drag Racing . . .**

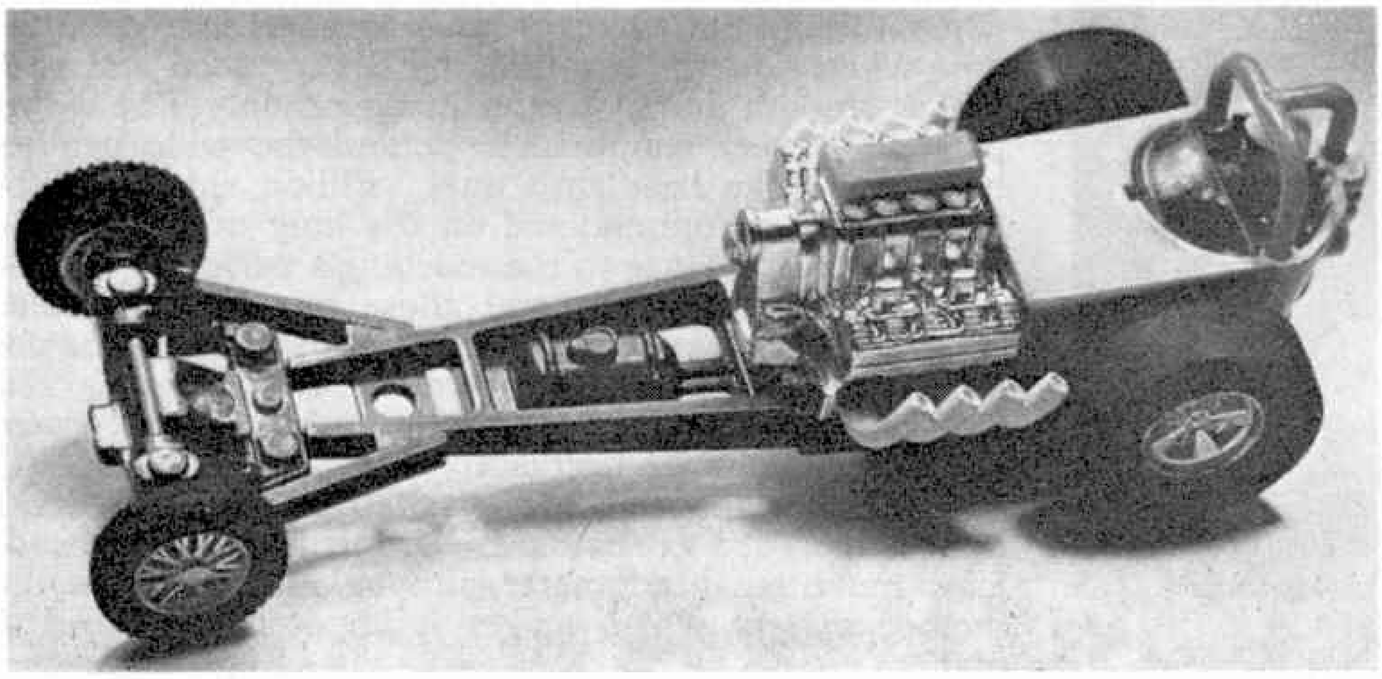
Still on a high-speed theme, although not in the rallying field, we have something for Drag Racing fans.

Already a proven winner in the die-cast model world is the Dinky Dragster Set, containing the dragster, " Inch Pincher " and a special spring Starter Unit. Now collectors can build up their own competitive drag racing stable ! By popular demand, both the Dragster (in modified form) and the Starter Unit have been made available for separate sale, the former retailing in the U.K. at 8/6d. and the latter at 6/11d. Marketed under Sales No. 228, and known as the Super Sprinter to avoid confusion, the " new " Dragster is basically the same model as packed in the Set, but without the clip-on chassis cowling and finished in an entirely different colour scheme of fluorescent orange body on a metallic blue chassis complete with a bright-plated engine sporting white " chopped off " exhaust pipes. In general appearance it is typical of all custom dragsters with its long, narrow shape, small front and huge rear wheels, enormous centrally-mounted, highly detailed V-8 engine, open to view, and a helmeted driver squeezed into a small cockpit at the rear of the body. The cockpit, itself, sports a windscreen, while the driver is protected by a removable anti-roll bar. Speedwheels are fitted for extra high performance.

The Starter Unit is identical to that packed in the Dragster Set with a spring-loaded Plunger that slots into a hole in the back of the Dragster. Pressing a button on the top of the unit sends the Dragster streaking away !

Ever since the Dragster Set first appeared, there have been requests for the Dragster, alone, to be made available separately so that collectors can build up a good team. The Super Sprinter meets the bill, and provides the necessary competition to ensure an action packed meeting, anytime !

Above: Posed on a road map—the ideal setting for Dinky Toy No. 213 Ford Capri Rally Car !



Left: Dinky Toy No. 228 Super Sprinter —basically the dragster packed with the existing Dinky Dragster Set, but with modifications.

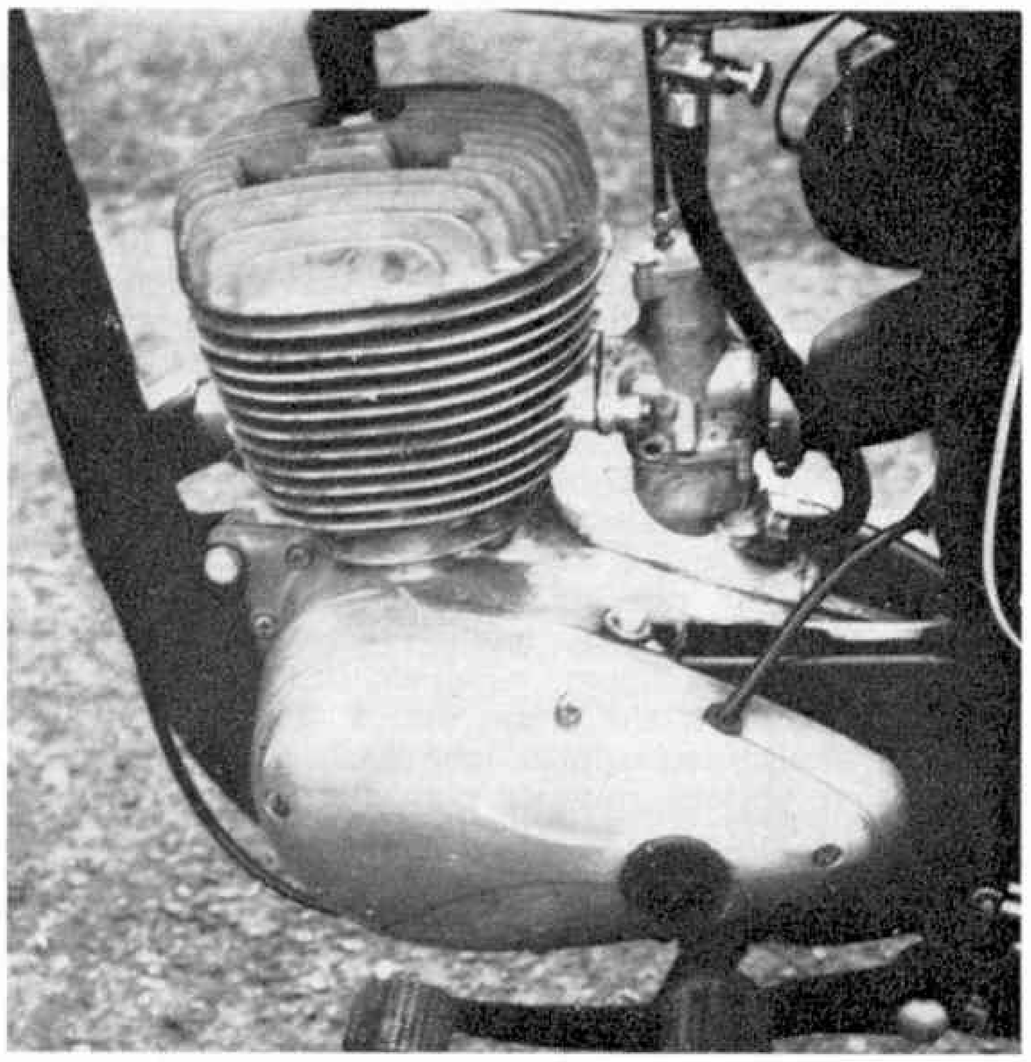
# ON TWO WHEELS

## *A tough lightweight from Britain . . .*

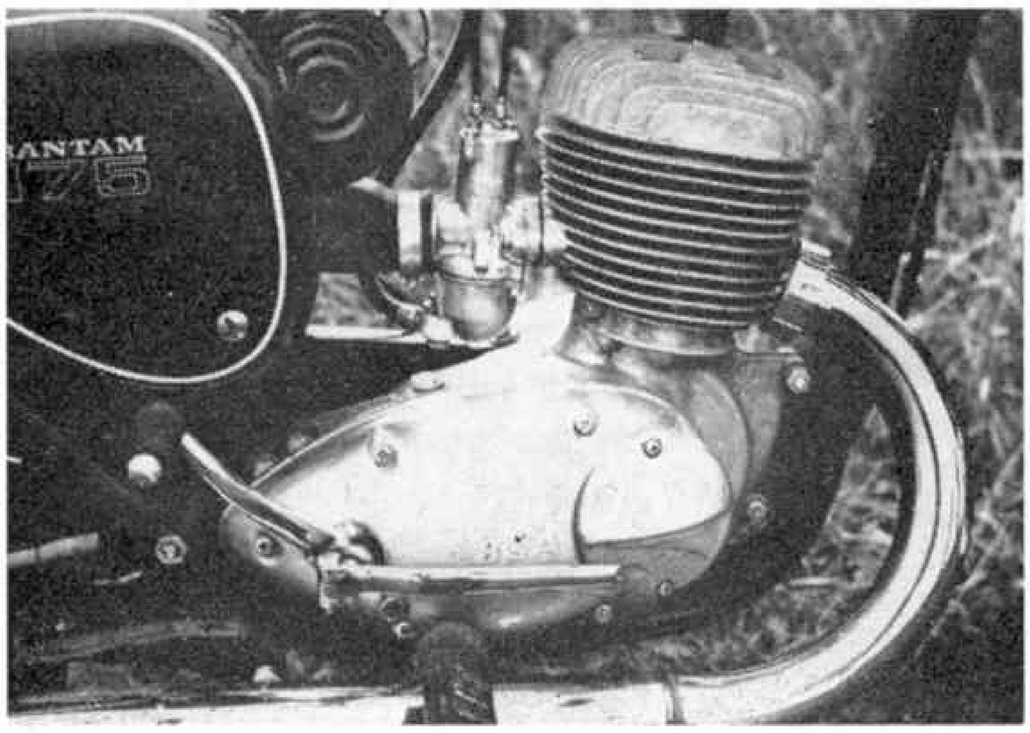
Above : Keith Emerton, one of our test riders, puts the Bantam through its paces.

As you will no doubt have seen from the leading photograph on this page, this is the ninth test in our series, and for us it is something rather special. The B.S.A. Bantam, subject of our review this month, is the first all British machine to be sent to us for test purposes. It was natural that many of our test riders would try to compare the Bantam with the Japanese motorcycles that have been the subject of previous tests, but perhaps this is rather unfair. The Bantam makes no pretence of being a high performance, brightly finished machine and has none of the extras that are standard on many foreign machines, such as winking indicators, neutral warning light, twin stands, etc. What it does instead offer a would-be owner, is economy and reliability, complete with ease of handling and good, but not exceptional, performance. From the amount of riding we put into this little bike we would agree that these are its most appealing points. Readers may be interested to know that the first B.S.A. Bantam rolled off the production line in 1949, and since that time more than ¼ million of them have been produced, the D14/4 173 ccs. Bantam (to give it its full title) being the latest in the long line, and also the most powerful.

Starting the Bantam is fairly straightforward, once the correct amount of choke has been determined. Switch on the ignition, " tickle " the carburettor until it floods. Open the choke slightly, and the two-stroke single cylinder engine bursts into life on usually second or third swing of the kickstart.



This nearside shot of the engine unit shows its clean lines and freedom from wiring and cables.

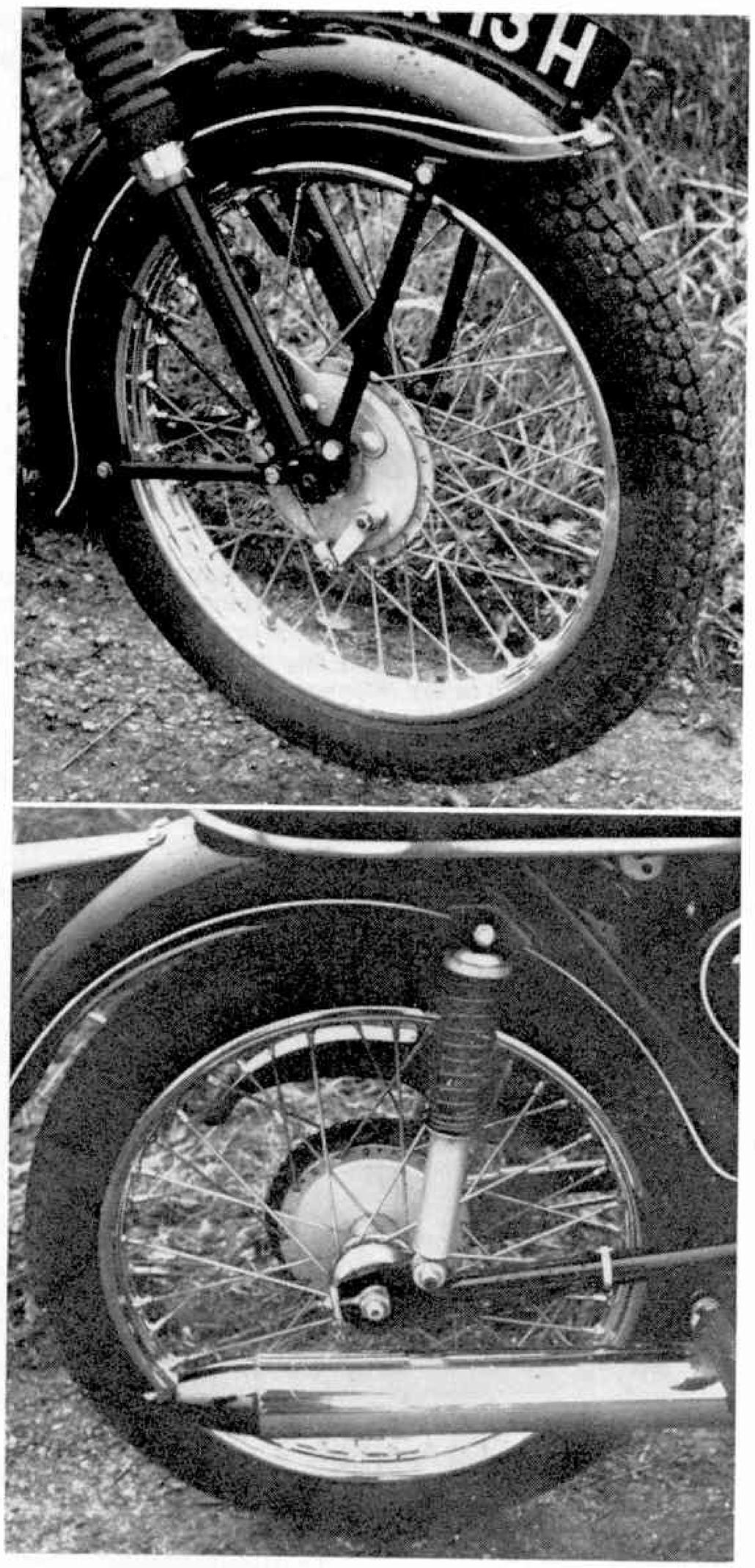


The heart of the updated Bantam is the 173 cc. two stroke engine. Rather noisy but very willing.

The Bantam is a rather noisy machine, especially when idling, but changes to a rather more subdued note when ridden. Roadholding is very good and both brakes smooth and powerful in operation. The riding position is very comfortable behind the wide handlebars, and large headlamp unit. Pillion riders can be comfortably accommodated on the long dual seat, and make little difference to the machine's performance.

Controls are simple, and those on the handlebars kept to a minimum. Dip switch/horn and clutch on the left, and front brakes and throttle on the right. The ignition switch (no key) and lighting switch are located on either side of the headlamp unit.

Lighting is above average on the Bantam, and a brake light is included as standard. Unfortunately, the headlamp mounted speedometer, although accurate does not include a light which makes it impossible to read at night.



The wheels of the Bantam, with their lack of polished aluminium and unusual brake hubs look rather old fashioned for 1970.

### The Bodywork

The appearance of the Bantam is to be blunt, rather old fashioned ! Finished in black cellulose with only a chronium plated exhaust and tank to relieve its severity. The paintwork is, however, excellent in its finish, typical in fact of the whole machine.

The fuel tank (holding 1⅞ gallons) gives a cruising range of approximately 160 miles but, unfortunately, does not include a reserve supply.

As we said earlier there is very little in the way of polished alloy on the Bantam, the engine being the only part of the machine featuring this.

### The Engine

Power for the Bantam is supplied by a 173 ccs. two-stroke, rather noisy but delivering far more power than on previous lower capacity models. It's rather a noisy unit, but most of this could be attributed to the rather poor silencer.

The unit is clean and tidy in appearance, certainly easy to get to for the usual minor repairs.

Once the correct choke position has been determined (something only experience can bring) starting the engine by the well positioned kickstart was fairly easy, and on the road warmed up within a few minutes.

### The Gearbox

The four speed gearbox, operated by the right foot was straightforward and had no apparent vices. The " feel " through the gears was excellent although some riders experienced difficulty in selecting neutral.

### Summary

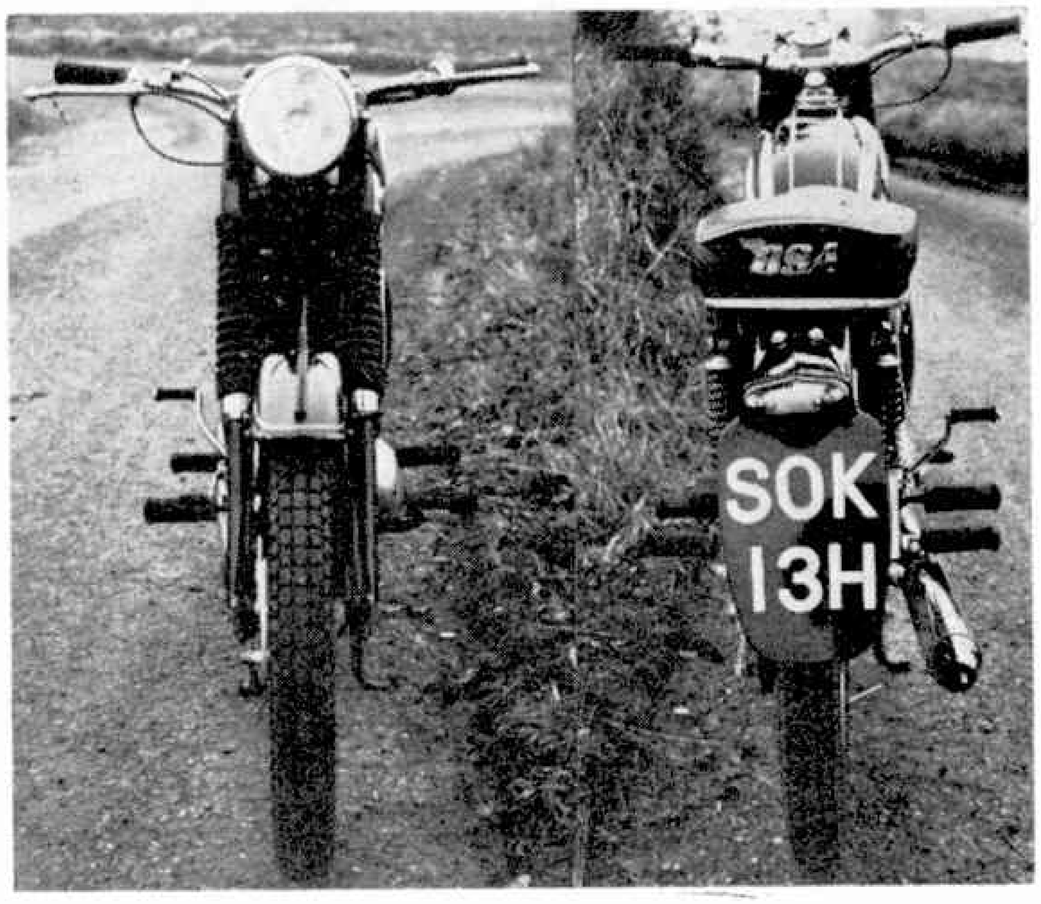
As a reliable means of transport, the Bantam has much to commend it. Comfort, good roadholding and sound construction give the impression that it will give many years of good service.

We would have liked a few more " extras " (if that be the correct words). An ignition lock, steering lock (there is only provision for a padlock, not supplied) and a reserve petrol supply, and perhaps just as important, a tool kit.

Its price at £134 is very competitive and certainly makes it worthy of consideration.

### Accessories

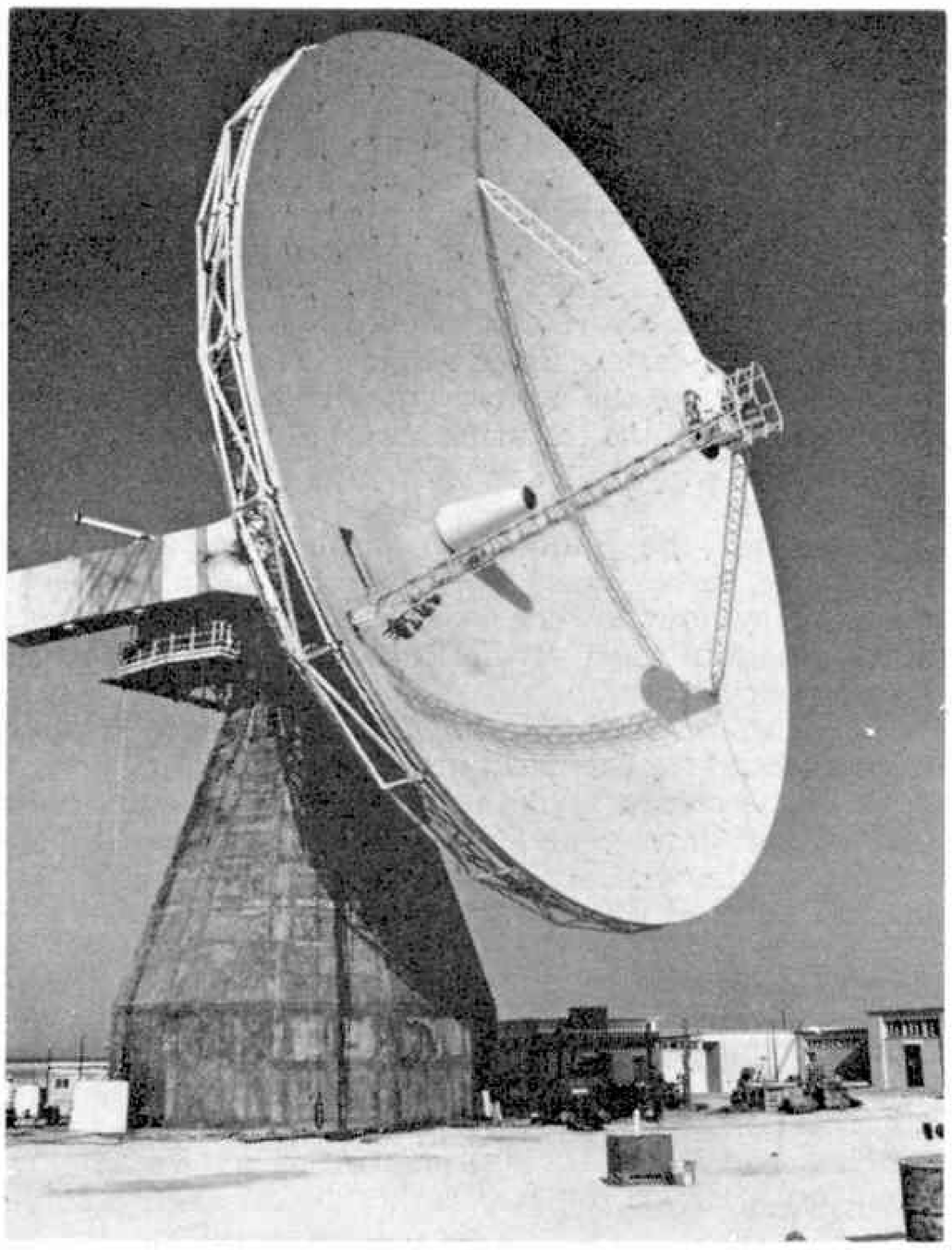
As with most machines a wide range here including:— screen, legshields, luggage racks, etc.



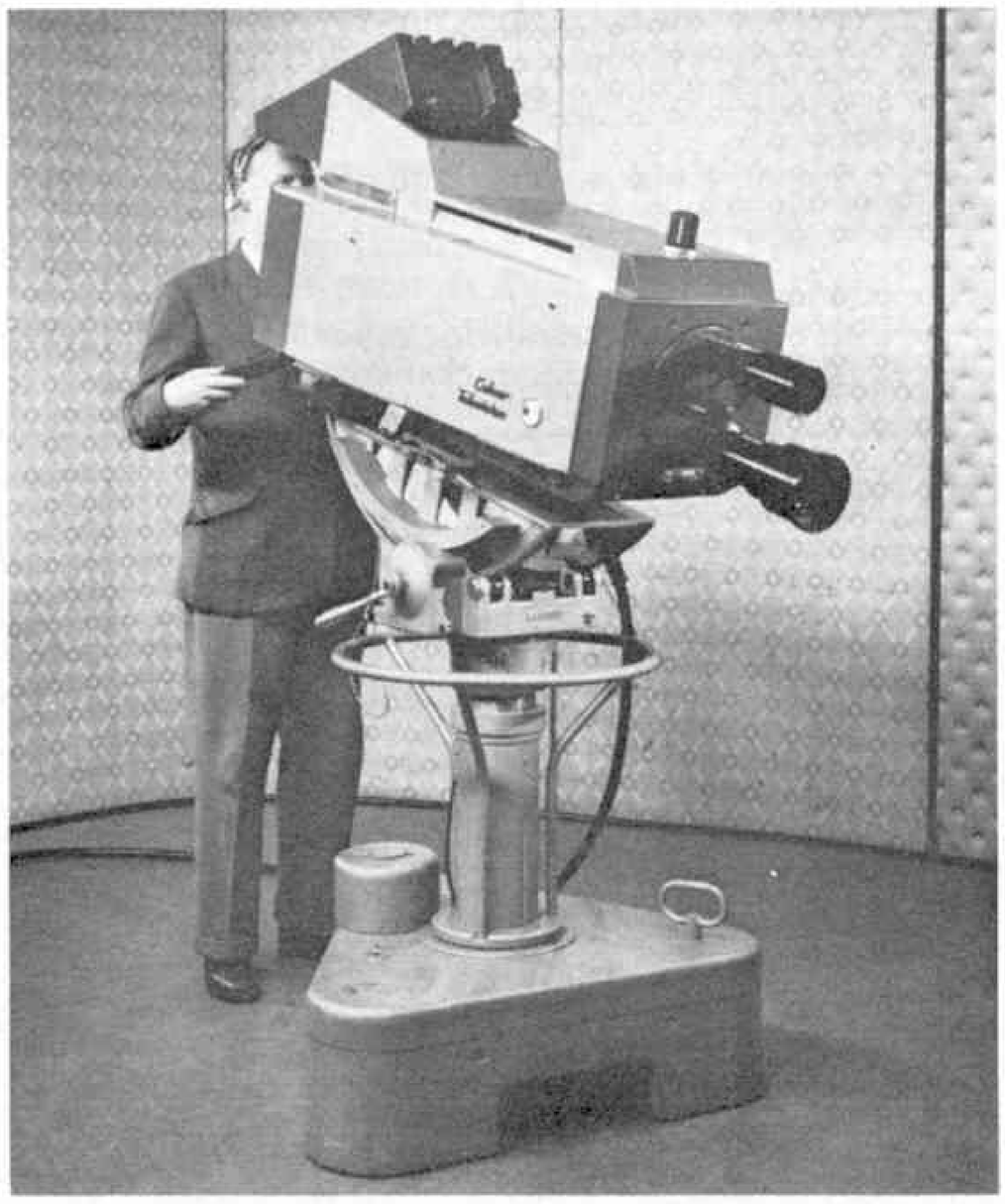

### FOR THE TECHNICALLY MINDED

| | |
|---|---|
| Cubic Capacity | 173 ccs. |
| Maximum power | 13 b.h.p. |
| Consumption (per gallon) | 80 miles |
| Weight | 215 lbs. |
| Gear Ratios | 1st 18.68 : 1 |
| | 2nd 12.04 : 1 |
| | 3rd 8.55 : 1 |
| | 4th 6.58 : 1 |
| Tyres : Front and Rear | 3.00 × 18 |

Common Dimensions : Length 77½ in., width 27¾ in.
Available Colours : Black.



This giant space communication station built in Bahrain by the Marconi Company is capable of transmitting signals by a satellite over most of the globe. *Photograph by courtesy of the Marconi Company Ltd.*



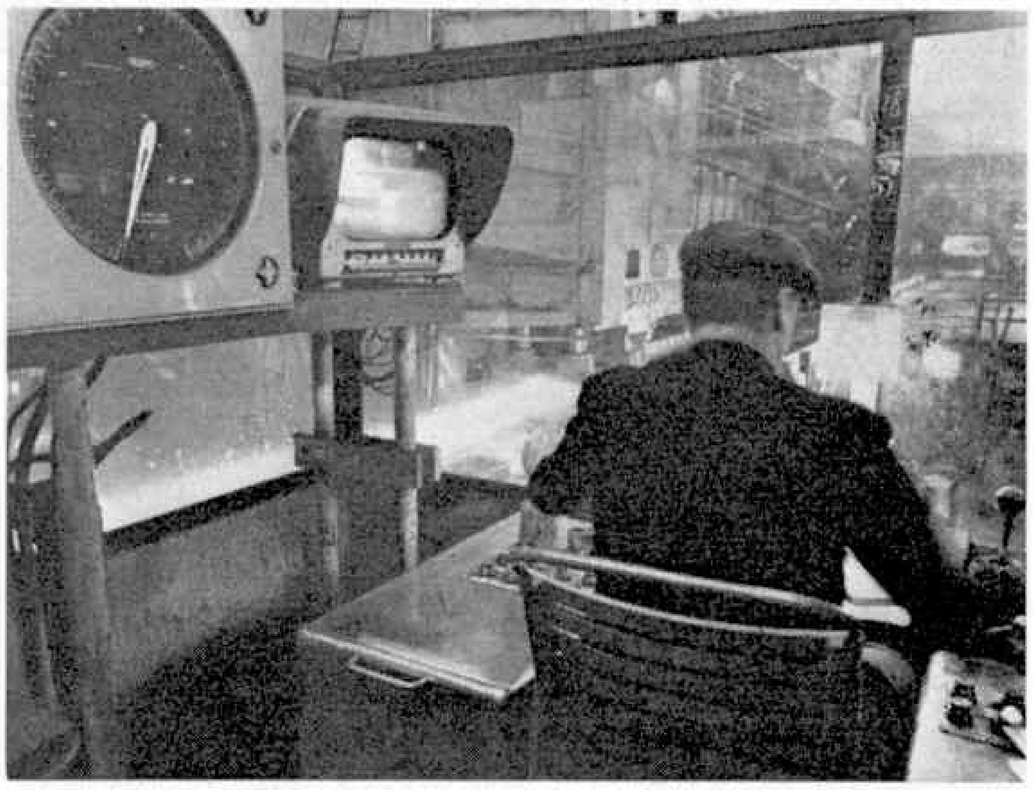
Although only recently operational, experiments have been made with colour televisions for many years now. This model was built in 1962. *Photograph by courtesy of the Marconi Company Ltd.*

# THE STORY OF TELEVISION

## by

## Charles A. Rigby

LIKE MANY of the wonders of scientific endeavour, television was gradually developed after many years of patient experiment and research. In 1847, Bakewell devised a system of transmitting still pictures over telegraph wires by 'scanning' the subject piecemeal in a series of lines. Another invention by a German engineer, Nipkow, employed a spiral of holes in rotating discs operating in synchronism for transmitting and receiving, to achieve a scanning process.



Television plays an important part in industry. A television system enables this operator to see objects normally out of his field of vision. *Photograph by courtesy of the Marconi Company Ltd.*

Without certain vital components, however, he had to give up, and many other methods failed for similar reasons.

Then in 1907, Rosing of Russia, devised mirror-drum-scanning at the transmitter and a rudimentary cathode ray tube for presenting the received picture. In 1908, Campbell Swinton suggested a system for scanning the image at the transmitter by a c-r-t, and for presenting the picture received. Although impracticable at the time, this employed the basic principles of today's high definition systems.

After World War I many experiments were carried out by Baird in Britain, and Jenkins, Zworykin and Dr. Alexanderson in America. Baird demonstrated 'Noctovision' or TV in darkness, using infra-red; Transatlantic; Colour, Outside Broadcast; and 3-D, all within three years. However, although his 30 line 12½ Frame transmissions were a novelty, entertainment

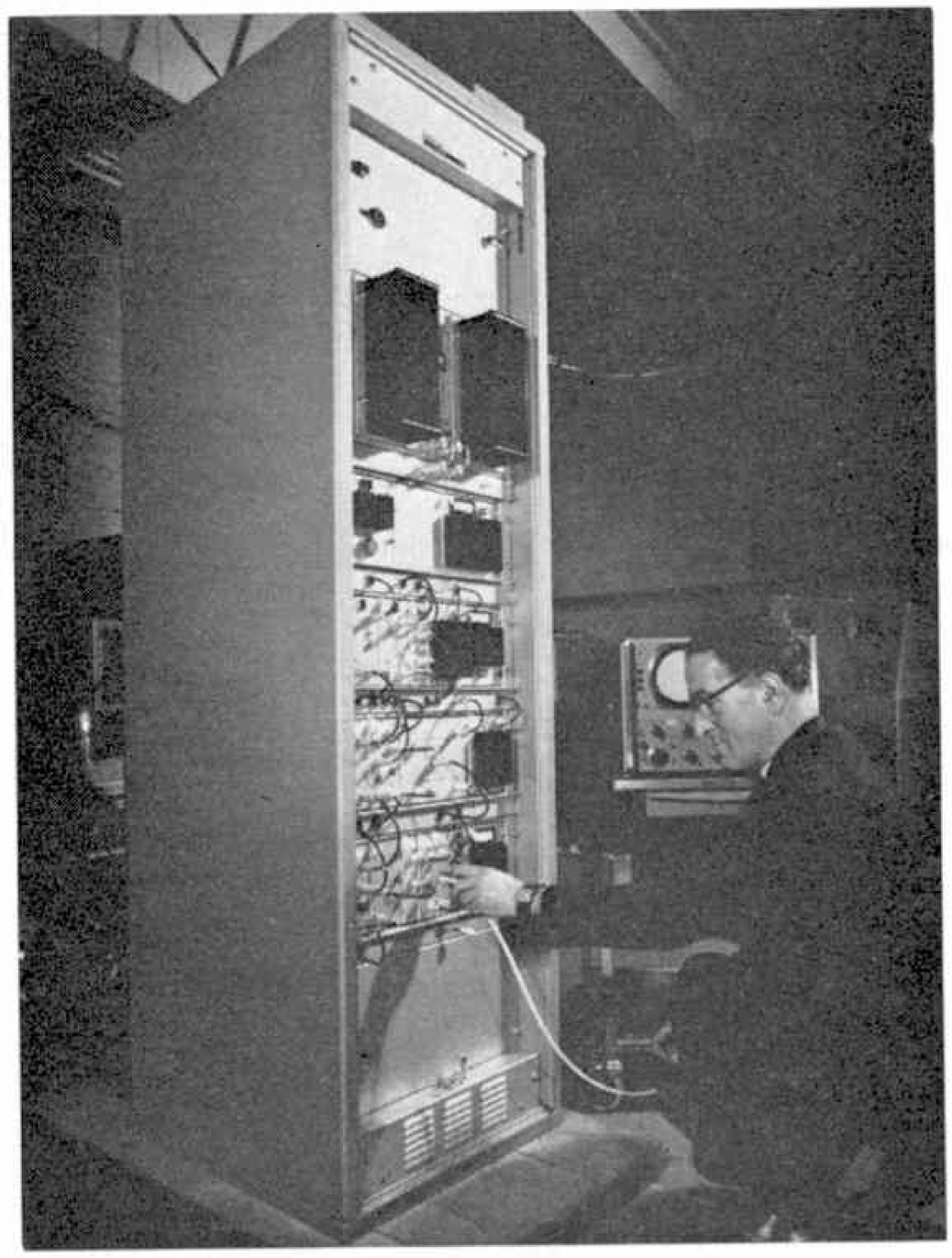
value was negligible, the received images being tiny and almost completely lacking in detail.

From 1929-1934, there was much activity in Britain with the Marconi Company, E.M.I. Ltd., and Baird, all competing in this field. Hence in 1934, a committee under Lord Selsdon was formed to look into the possibility of establishing a permanent service. In 1936, the rival companies set up their equipment at Alexandra Palace. Baird employed 240 line scanning with 25 pictures per second, while the Marconi & E.M.I. Co's had all-electronic interlaced scanning on 405 lines, using 'Emitron' cameras as the picture sources. This station was formally opened with Baird's, and Marconi-E.M.I. Ltd. operating their equipment on alternate weeks. The receivers used employed cathode ray tubes and had a switch to change from one line standard to another.

On February 5th, 1937, the PMG announced that henceforth only one system, the Marconi-E.M.I. Ltd. would transmit programmes. In this fashion, began the world's first TV service in Britain which served until 1956, when the BBC station at Crystal Palace commenced operation. With the improvement and extension of programmes, and the formation of other important services, this new entertainment medium with its modern magic of bringing world events into the home, and broadening man's horizon, became a unique form of entertainment.

**This remarkable device can produce the effect of a wide variety of printing exposure times and can magnify selected areas of the photograph up to twenty times.** *Photograph by courtesy of the Marconi Company Ltd.*

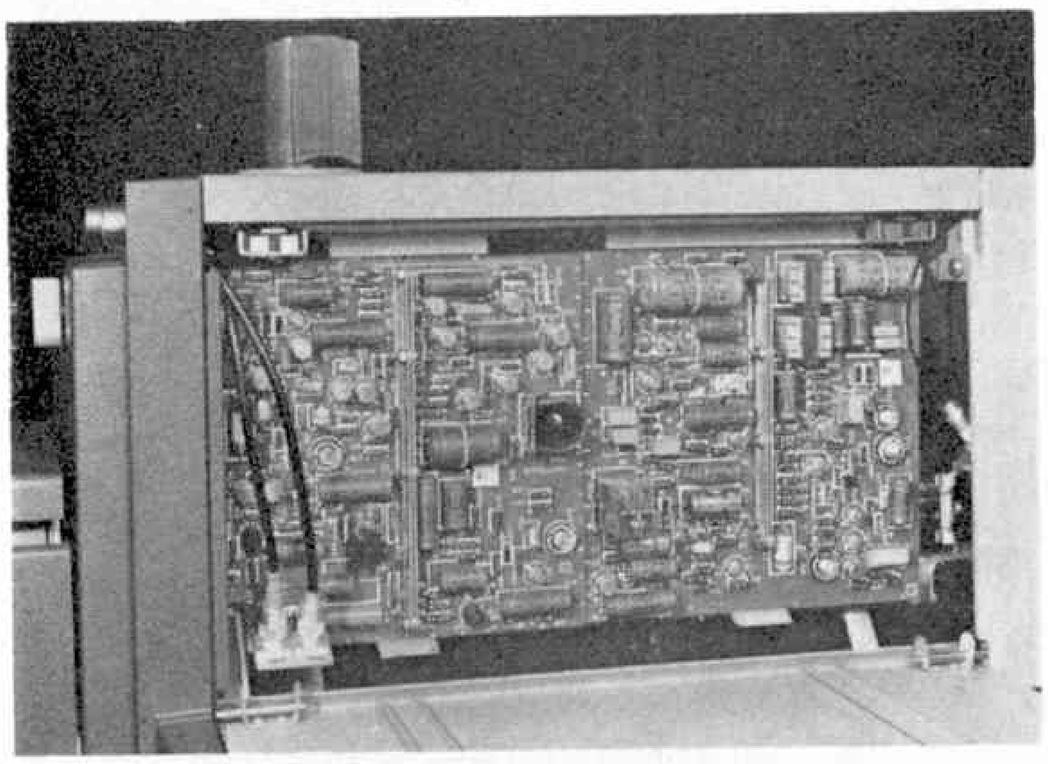
For its success, the essentials depend entirely upon technical perfection and the producing and telecasting of programmes. Teleshows may be divided roughly into two groups—'live' and film. Certain terms require explanation. A Frame is one of a series of complete pictures. In present standards, pictures are transmitted at the rate of 30 Frames per second, giving the effect of a moving picture. In relation to film, a Frame is one



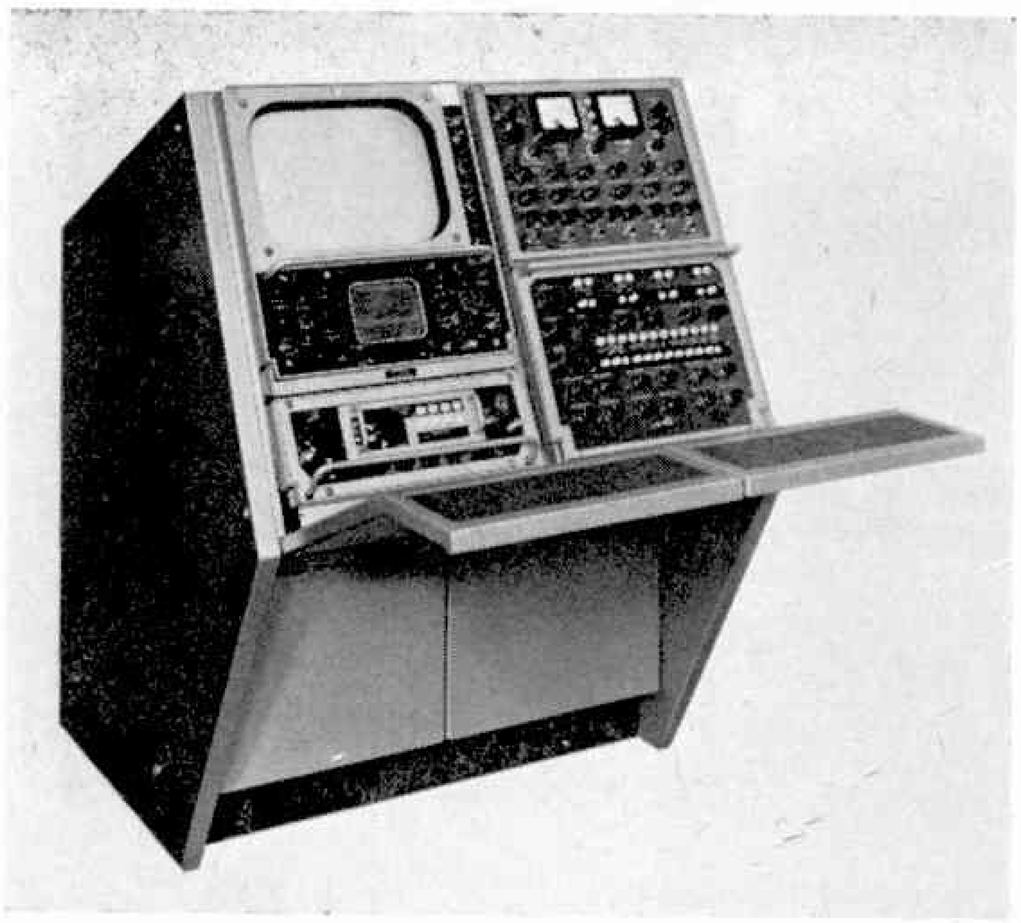
**Shown above is one of the latest television transmitters designed by Marconi.** *Photograph by courtesy of the Marconi Company Ltd.*

complete picture in a 35 mm. or 16 mm. film. The 35 mm. motion picture films are projected at the rate of 24 Frames per second. The Picture Line Standard is the number of horizontal lines scanned per second for each image Frame. British Line Standards are 425, and 625.

'Tele' is Greek for 'at a distance', and 'vision' means 'ability to see', so television is the ability to see at a distance, using a receiver. For this purpose, it is



**This photograph shows the left hand side of the Marconi Mark V. camera with the cover removed. Circuit construction, consisting of plug-in boards and units is clearly shown.** *Photograph by courtesy of the Marconi Company Ltd.*



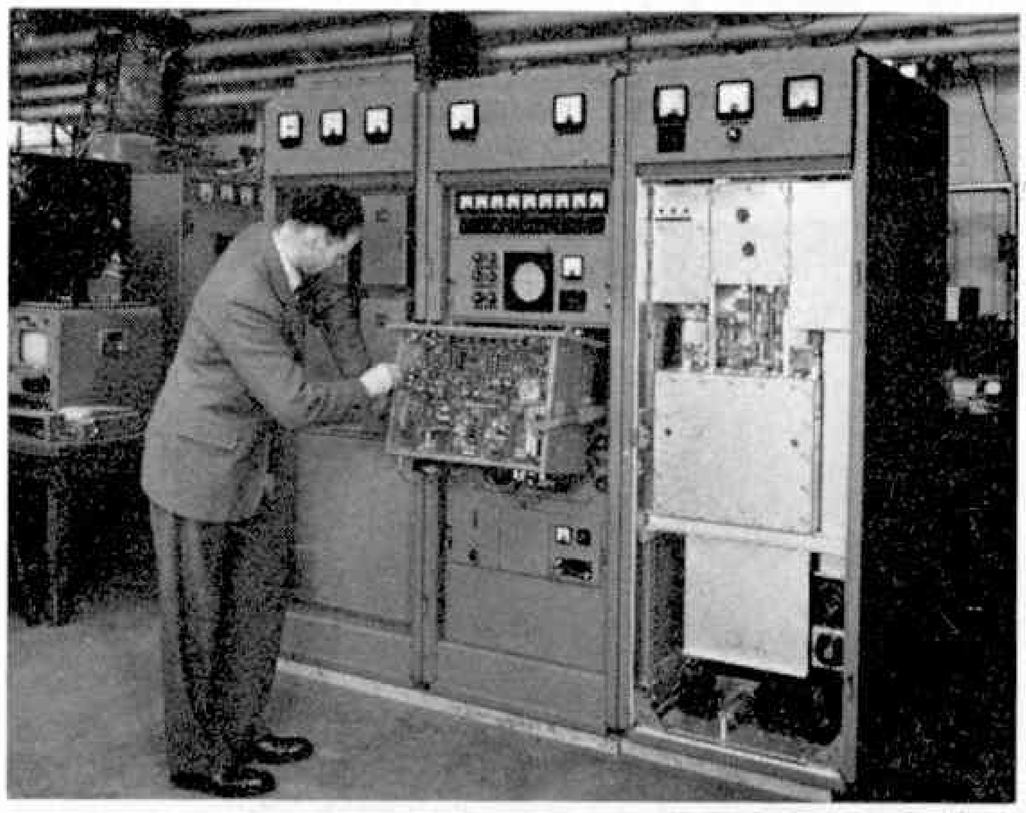
**The screen of this colour television receiver is only 3 in. across and was constructed in 1962 for use in outside broadcasts in America.** *Photograph by courtesy of the Marconi Company Ltd.*

necessary to transmit about 3-million picture elements every second to produce a complete picture of acceptable detail or definition. Only one element can be transmitted at any one time so in order to convert a light image into an electrical signal, the image or picture is divided into the smallest number of parts, which when re-assembled will result in an acceptable reproduction of the original. The process can be compared with cutting a photograph into very tiny pieces, sending these one by one to the receiver and assembling them into the picture. This is done by substituting impulses for each picture.

Within the cameras used is a vacuum tube, or image Orthicon, known as the ' Iconoscope ', whose function is to reproduce the scene at which the camera is looking as a series of electronic impulses. The images focus on a photo-sensitive plate at the back of this, and then they are converted into a series of pulses which travel via a cable to the Control Room. There, the engineers monitor them and make up the pictures and sound, and both are carried instantly by very short radio waves to the transmitting station where they are broadcast for reception by receivers using a picture tube.

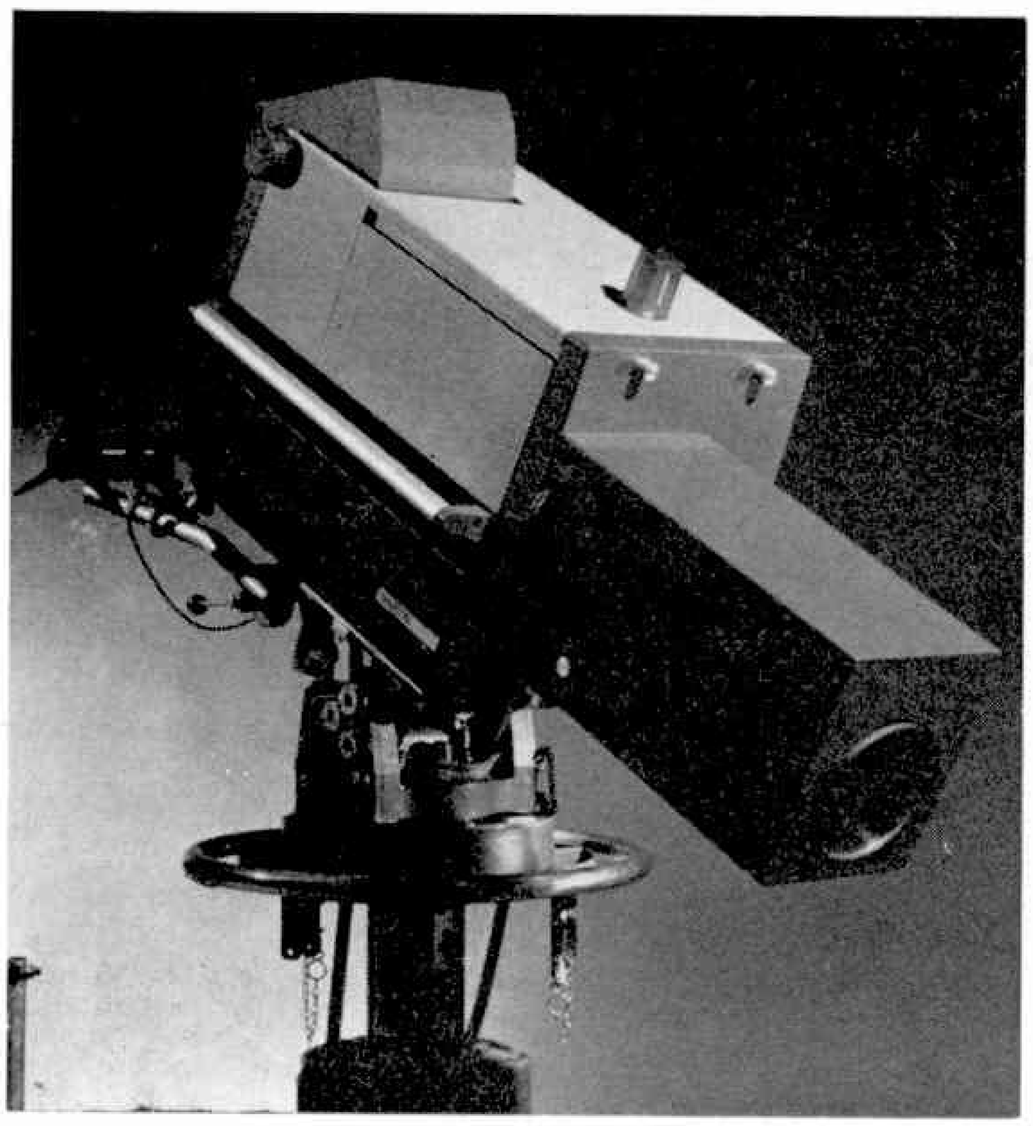
In these, the picture flies through the stem of the tube in a beam of electrons that plays across a fluorescent screen at the closed end of the funnel. There, the impulses are converted again to the varying degrees of light that form a picture on the receiver screen. Sound is produced in the loudspeaker. Provided with a ' Zoom lens ', the cameras can be operated in the ' pan ' and ' tilt ' positions. The beam of electrons in the ' Iconoscope ' scans the mosaic from left to right, from top to bottom, line by line, in the same fashion as one would read a book. As each tiny globule is struck by the beam, the element gives up its electric charge which rushes through the camera circuit amplifiers and over a multi-conductor cable to amplifiers in the Control Room. After scanning the first line it is necessary to return the beam to the left side to start the next excursion. If suitable precautions were not taken the beam would remove the picture elements from the mosaic on the return trip. This is prevented by an electric pulse called a ' blanking ' pulse which shuts off or blanks the electron screen during the return trip. With 625 Line Standard, 625 lines are drawn across the screen to cover the entire area 30 times or 30 Frames per second.

In the receiver, scanning is done in the same alternate manner, as that done at the Iconoscope, this being governed and synchronized by deflection coils. Picture quality is monitored by an operator at the monitor console, arranged in units, one for each camera channel. Each contains a white screen picture tube and wave-



**The above photograph shows the Marconi transmitter on test at the Company's Chelmsford works. The front doors have been removed and the cover unit removed for test purposes.** *Photograph by courtesy of the Marconi Company Ltd.*

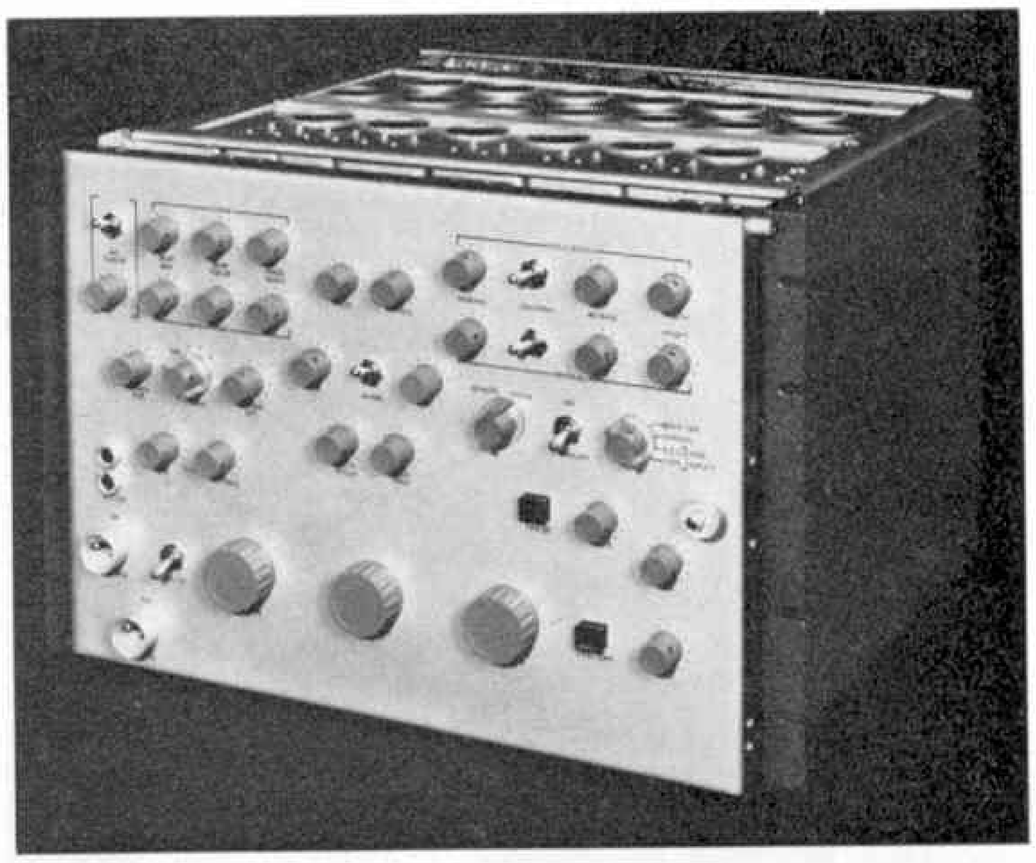
**The camera shown below was one of the first colour transmitters and was built in 1965.** *Photograph by courtesy of the Marconi Company Ltd.*



form monitor. Films are dealt with by film projectors in the Film Projection Room. Film slides are simple to handle, being still photographs shot on 35 mm. motion picture film, and can be spliced together in the sequence required.

Equally important is the lighting arrangement in the studio, since lights and cameras, the essential of any form of photography present their own peculiar problems, the primary function being to give sufficient illumination to enable the film in the mosaic to reproduce clearly the subject being photographed. This is the reason why such a high level of general lighting is used.

World-wide coverage became possible with the use of satellites in orbit and ground stations, as with Telstar in July, 1962. Since that time the system has been extended with satellites in synchronous orbits over the largest oceans. Many other countries now have adopted the system both for telephone and TV broadcast purposes. On February 20th this year, the GPO Goonhilly Downs Station handled the first regular TV broadcasts between Britain and Ceduna in South



**A camera control unit for a Marconi Mk. 5 camera.** *Photograph by courtesy of the Marconi Company Ltd.*

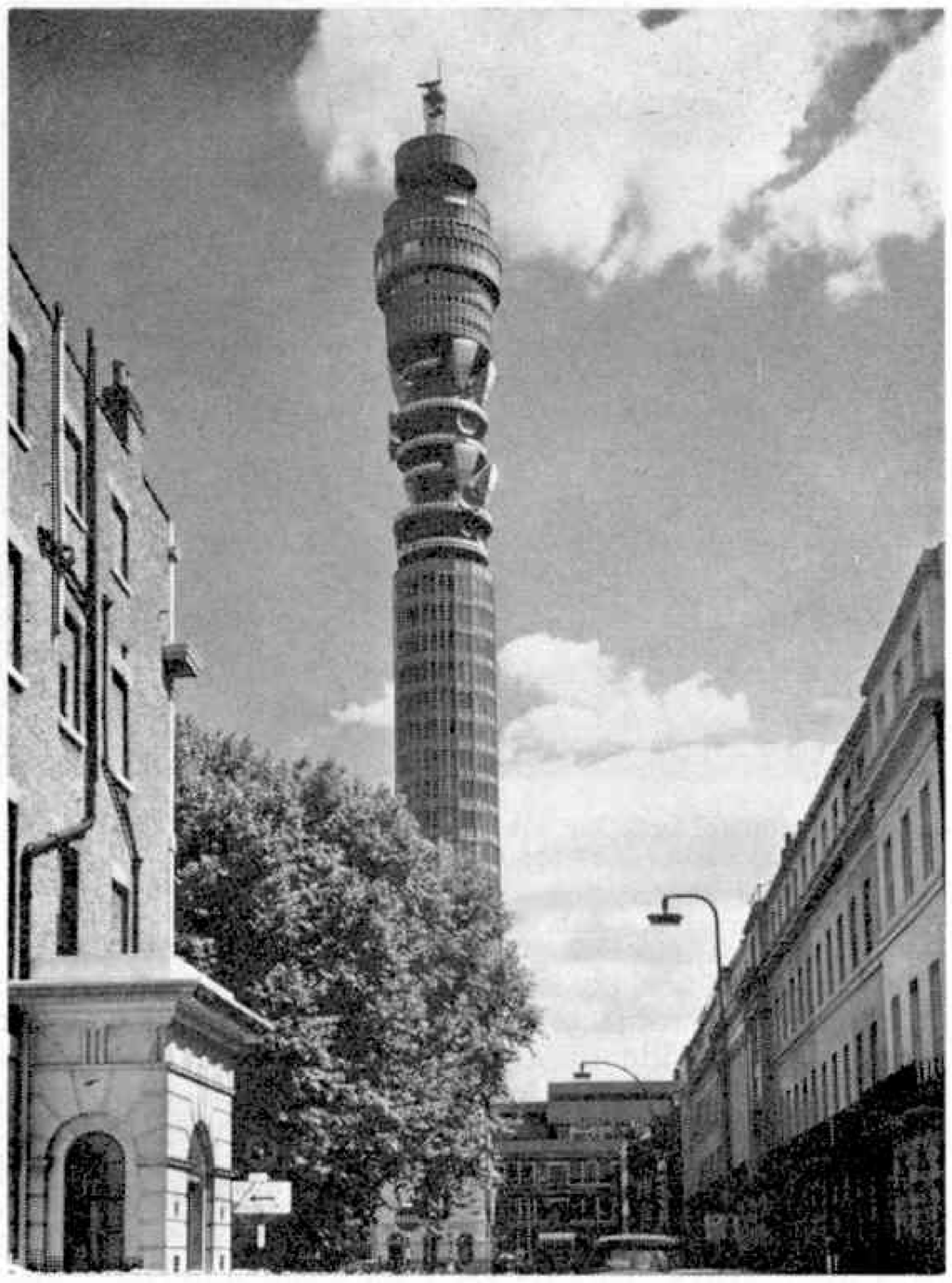
**Work being carried out on a colour telecine unit.** *Photograph by courtesy of the Marconi Company Ltd.*

Australia. Programmes have already been exchanged with Kuwait, and exchanges with Kenya and India are expected. Made possible with the use of a specially made light camera, most outstanding was the broadcast of both the ' Apollo ' missions showing the astronauts walking on the Moon.

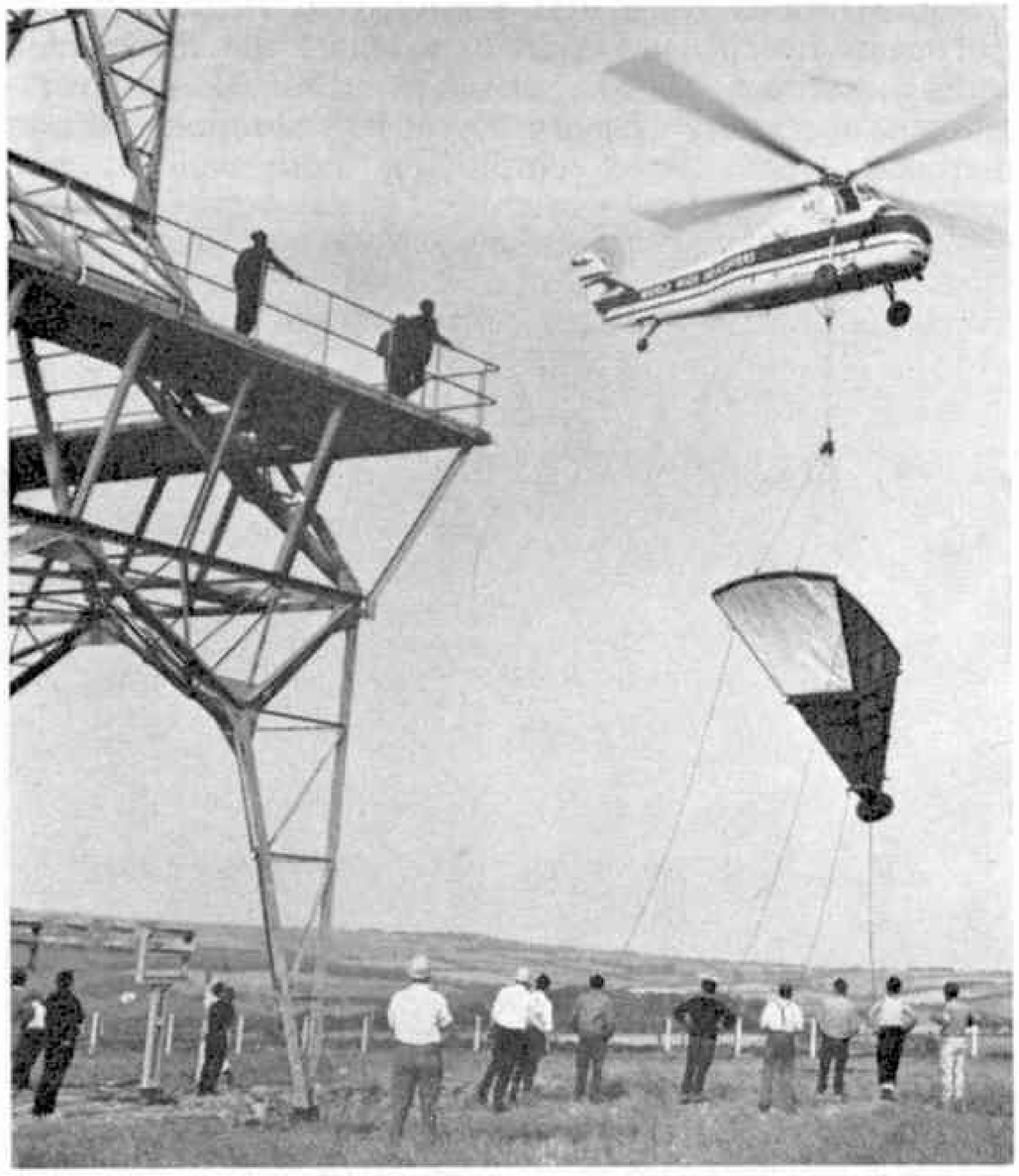
Another important development, closed circuit television, making use of Vidicon cameras, display monitors and other important equipment differs from national open circuit broadcast where the signal can be received over a wide area. It is essentially a private system, the signal being normally transmitted by means of a coaxial cable. Again, it is not restricted to a camera and a display unit. The picture from one camera can be displayed on several monitors simultaneously, and each of these can be switched to receive a picture from any number of cameras. Thus, there is really no limit to the number of combinations of cameras and monitors that are possible. Used for viewing remote or inaccessible objects or places, it is employed for viewing the inside of a furnace, observing the blind side of a rolling mill, locating weld metal in a tube, investigation of corrosion or defects in tubes or boilers, matching instruments in restricted places, relaying lectures to several classrooms, and for locating objects on the sea-bed. With so many advantages it has many uses in industry, commerce, education, entertainment, public utilities and other services, and the number of uses is steadily growing.

The last few years has seen the introduction of colour TV in Britain, America, and many other countries. Demonstrations were first arranged in Britain by the European Broadcast Union to evaluate the three main coding systems, NTSC, SECAM and PAL in simultaneous operation. Before actual introduction, various methods were tested employing both colour, and separate ' luminance ' cameras. Colour serves not only to please the eye. What is seen looks even more real—in fact, really LIVE. The greatest benefits derived have been not only in entertainment, but education.

**A view of the camera control consoles and equipment racks at English Electric House.** *Photograph by courtesy of the Marconi Company Ltd.*



London's 620 ft. Post Office Tower. The aerial galleries occupy a little over 100 feet of the height of the tower immediately below the public viewing galleries and revolving restaurant.



The large horn paraboloid aerials used in microwave radio systems can provide transport problems. Here a helicopter brings an aerial to a remote radio tower in South Wales.

# EXPANDING MICROWAVE COMMUNICATIONS

## by W. H. Owens

MANY READERS WILL HAVE VISITED the Post Office Tower in London—Britain's tallest building—to enjoy the thrilling views over the city from the public galleries, nearly 500 feet above street level. Some lucky ones may have had a meal in the unique Top-of-the-Tower revolving restaurant, which gives patrons a continually changing panorama of London through its glass walls.

But the main purpose of the 620 ft. high tower is to carry trunk telephone calls and television programmes between the capital and the rest of the British Isles. This London tower, and a similar 500 ft. tower in Birmingham, are key points in a high-frequency microwave network of 130 stations, stretching as far north as Inverness and west to Belfast and Dublin.

All over the world today microwave radio systems are used for operating long-distance telephone services. One of the most remarkable is the 3,000-mile link across Canada, connecting the Montreal end of the Atlantic telephone cable with the start of the Pacific cable at Vancouver. Microwave networks are much less difficult and costly to construct than conventional overhead wire or underground cable systems, which in many overseas territories would be quite impracticable anyway.

Here in Britain microwave communications have been developed rapidly over the past fifteen years. Today they play a vital part in the huge expansion programme of Britain's telephone service, and also provide the additional nation-wide channels required to distribute colour television. When operating to their full capacity, the Post Office tower aerials and associated radio equipment will provide for as many as 150,000 simultaneous telephone conversations, and up to 40 television channels.

Microwave radio signals travel in straight lines very much the same as searchlight beams. They are concentrated into narrow beams by focussing on dish-shaped and horn paraboloid reflecting aerials. These serve, in effect, as giant mirrors in the sky. The signals travel over a distance of 25 to 30 miles between the aerial systems of one relay point and the next, and so can be beamed along paths to distant parts of the country.

From the Post Office Tower in London the main microwave paths run towards Birmingham and the North; towards Southampton, Bristol, Wales and the West Country (including the link with the satellite earth station at Goonhilly, Cornwall); towards the Kent coast and the Continent; and towards Norwich and North-East England and Scotland. To ensure good

quality transmission, the path of the radio beam must be clear of all obstacles—buildings, hills, trees and so on. Outside cities this is achieved by mounting the reflecting aerials on steel towers on hilltops.

The reason why London's Tower had to be built to such a great height was to ensure the radio beams would pass well above the tallest office blocks already built or planned for the future. The only alternative would have been a ring of radio stations round the city outskirts, linked to a central exchange by cables. Apart from the fact that there were not enough elevated sites for aerials available near London, the scheme would have involved extremely costly cable-laying operations under miles of streets, with consequence traffic disruption and chaos.

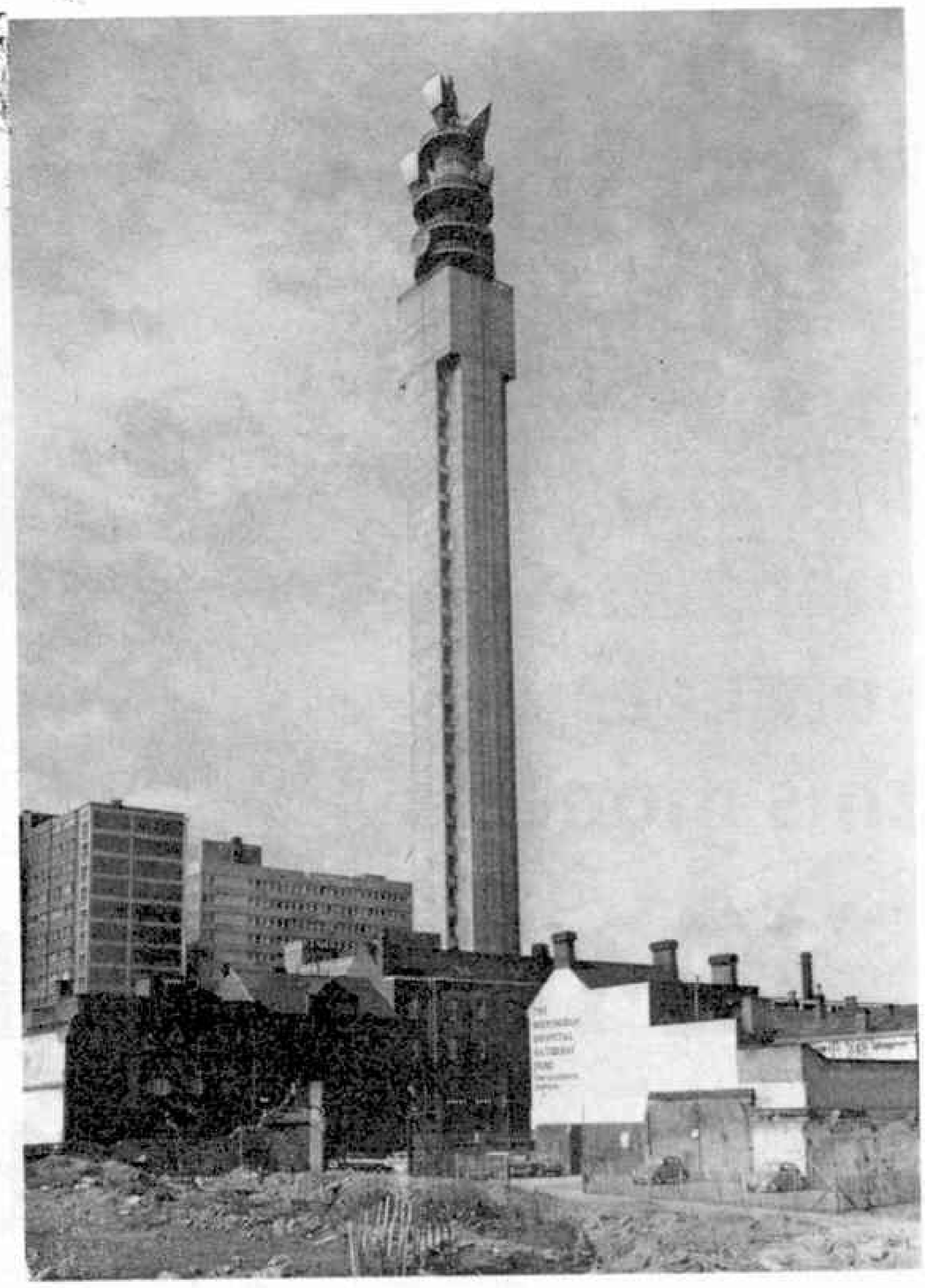
The most striking feature of the tower are the four aerial galleries, occupying one-sixth of its height just below the public viewing galleries. Upon them are mounted seven large horn aerials, alternating with dish-shaped aerials. Viewing them from the street below, it is difficult to realise that each horn is 27 feet high and 14 feet wide. They are made of aluminium alloy and weigh one ton apiece.

On the Birmingham Post Office Tower, where there are no public galleries, the aerials are sited right at the top. To erect them, steel guide rails—similar to a railway track—were fixed to the side of the tower, and the aerials were hoisted by a crane at the top. Engineers above and below kept contact by telephone. Erecting the London aerials, too, was one of the trickiest parts of the whole tower project, and had to be done under the right weather conditions with very little wind.

Tall towers are always subject to some movement in gale force winds. In the case of the Post Office Towers, however, an exceptionally high degree of stability was required. Even slight angular movement by a microwave aerial will cause distortion resulting in a serious loss of received signal power. Therefore the towers had to be designed so that in a wind force of 100 mph, the maximum sway at the top would be only 15 inches from side to side. In fact, the greatest movements recorded so far have been considerably less. Before construction began, special scale models underwent exhaustive tests in a wind tunnel at the National Physical Laboratory at Teddington.

The tower aerials are the only visible pieces of radio equipment. But on the seventeen apparatus floors immediate below them, the London tower houses what is probably the largest collection of complex modern telecommunications equipment in Europe, if not in the whole world. Between this radio equipment and the aerials the microwaves travel through circular and rectangular waveguides—tubes of very precise construction to ensure the minimum loss of power. For the same reason waveguides and horn aerials alike are filled with dry, pressurised circulating air to prevent corrosion.

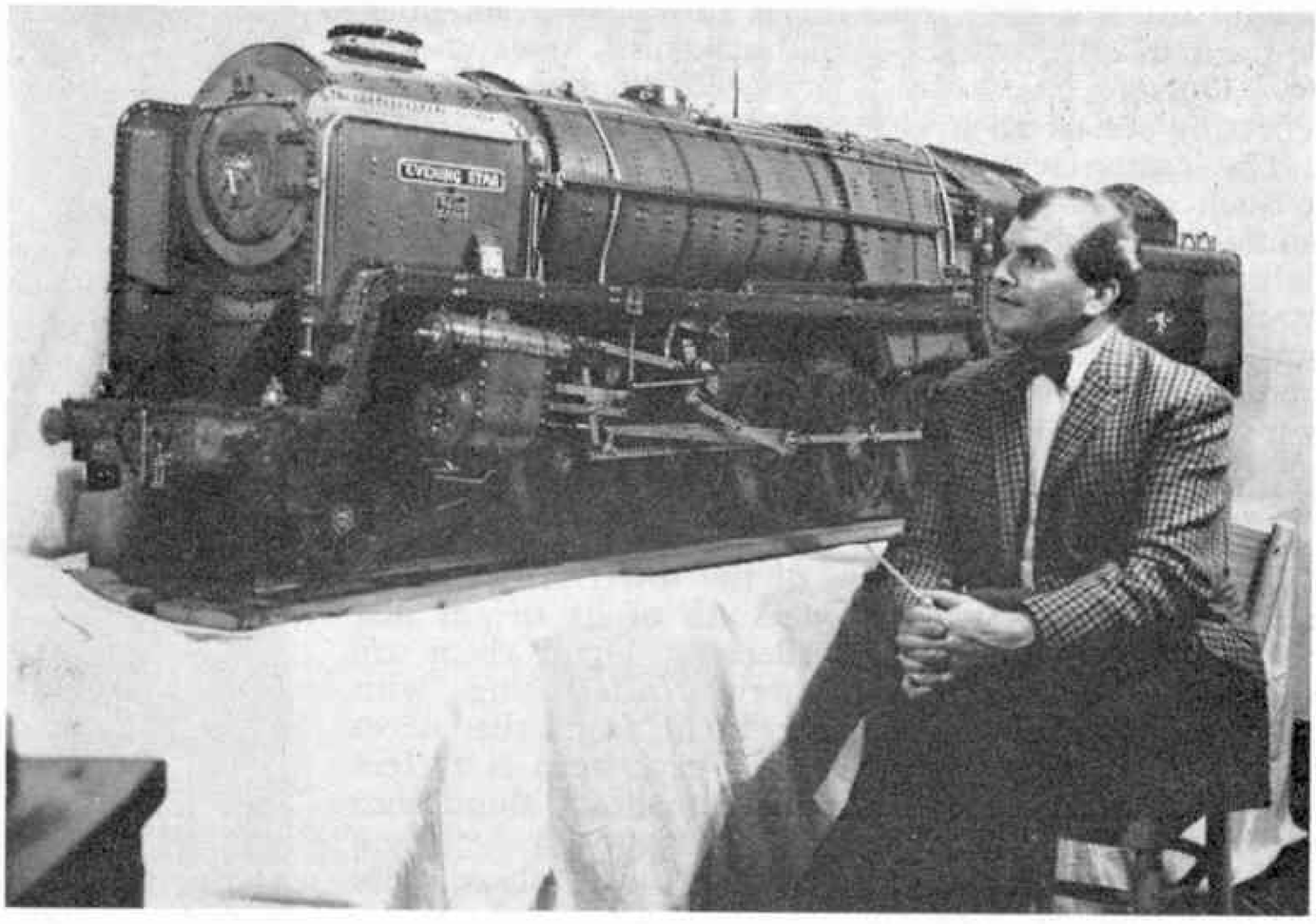
Perched right above the top of the tower is a 40 ft. high lattice mast which will carry yet higher horn and dish aerials in the future. Meanwhile, it is being used as a "sky weather bureau" over London by the Meteorological Office. The mast carries a large radar scanner by means of which rainstorms—or snowstorms in winter—can be detected up to about 200 miles away. With the aid of this equipment, the weather men can accurately plot the course and speed of any approaching storm and put out forecast warnings accordingly.



**Above right: The 500 ft. Post Office Tower in Birmingham with aerial galleries at the top.**

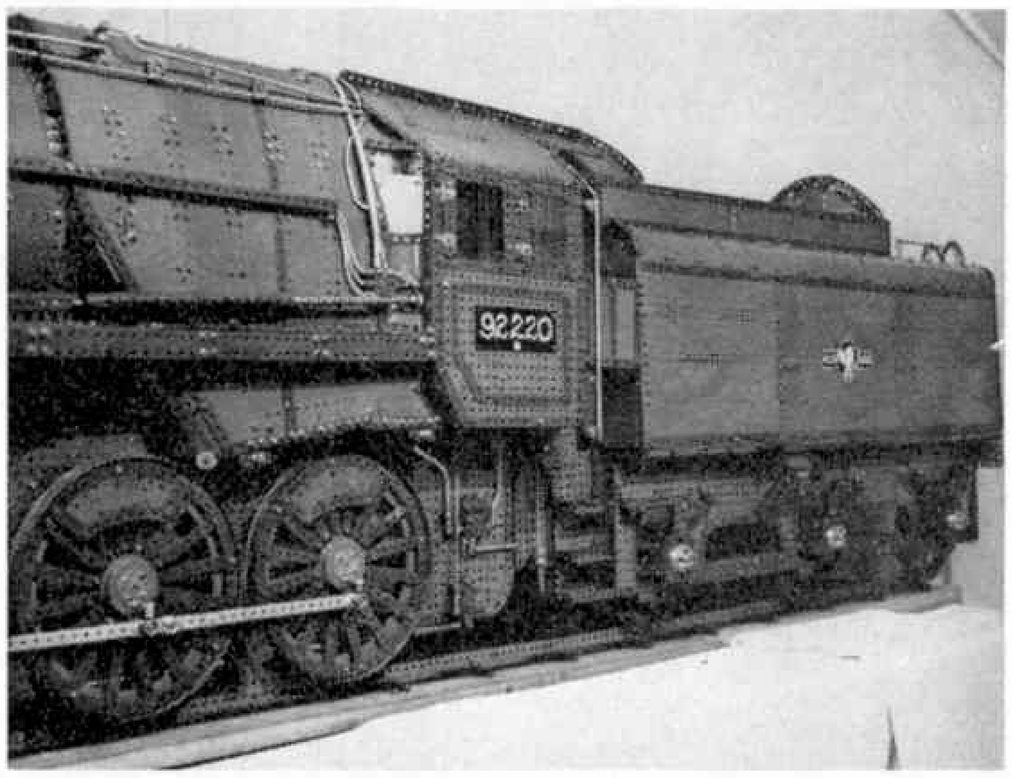
**Left: A view across London from one of the aerial galleries on the Post Office Tower, London. With a GEC horn-paraboloid aerial in the foreground.**

**A superb model of a Steam Loco' and a simple Lunar Movement are the subjects of this month's–**



# AMONG THE MODEL BUILDERS by 'Spanner'

IT IS TRUE TO SAY, I think, that every Meccano modeller now and again likes to see something of the work turned out by fellow hobbyists. For this, reason, we on Meccano Magazine are always pleased to publish details of readers' models when we have the opportunity—which usually means, when you supply us with details to publish ! The trouble with Meccano Modellers is that you like to remain anonymous !



**Heading photograph: Mr. B. W. Rowe, of Newton Abbot, Devon, pictured here with his excellent Meccano Steam Locomotive " Evening Star ". Some idea of the size of the model can be had from this photograph.**

**Above: A detail shot of the cab and tender. Note the clean lines of all curves and corners.**

Seriously, though, more and more readers are sending us photographs of their models, with descriptions, and these we like to pass on to you whenever possible. Unfortunately, however, the photographs supplied are often unsuitable for reproduction and occasionally the models themselves do not quite come up to par, but this could certainly not be said of the magnificent Steam Locomotive, " Evening Star " featured here. The work of Mr. B. W. Rowe of Newton Abbot, Devon, the model is one of the best examples of scale reproduction in Meccano I have ever seen. It must surely win a place for Mr. Rowe in the front rank of Meccano constructors, although I suspect Mr. Rowe, himself, would not agree with me. He does, however, have something to say about his model :

" I have been a keen Meccano model-builder for over 20 years ", he writes, " And have specialised in Steam Locomotives and Traction Engines which have been built to scale as near as is possible with Meccano —and built to a large scale. My model of " Evening Star " was the culmination of my steam locomotive building activities and I consider it to be a tribute, in Meccano, to the last Locomotives turned out of Swindon by British Railways. Consequently, I have done a great deal of research to enable me to complete the model as near as possible to the original and this has been achieved with standard Meccano components, with the sole exception of a few aluminium pieces to maintain the correct proportions.

" The model is over 11 feet in length, with the boiler more than 4 feet long. The boiler, itself, is " solid "—by means of overlapped Strip Plates and the liberal use of Bolts and Washers to fill in exposed holes. The cab is completely fitted out and the valve

gear is fully-operational from the cab. All ten main wheels are made up from Flanged Rings, Gear Rings and Face Plates, and the spokes are solid layers of Strips. Eight of the main Wheels are flanged with aluminium pieces made up for the purpose. The connecting rods are jointed to allow for fluctuations in the track and each wheel is correctly sprung as well as fitted with individual reinforced bearings. In fact, the lining up of the ten bearings was completed so carefully that the whole motion could be turned easily by hand. So that the motion may be observed in action, the model is raised from the track and, as a result, runs quite silently. A special mains electric motor is situated between the frame, and each is connected by 3 in. chain wheels, while the front pony truck is suitably geared up to give the correct motion effect.

" External piping is mostly supplied by Axle Rods, but rubber tubing, painted silver, is also used. A correct-style double chimney is fitted, plus the added copper band which was the characteristic of the old Great Western Railway. The boiler is over 1 foot in diameter and the building of this unit created a problem: due to its great length, all outside ancillary items had to be considered from the outset, as it was found to be impossible to reach into the barrel after construction was completed. The mainframes are built up in a robust fashion by the use of duplicate Plates and the ample use of Angle Girders for strengthening.

" A mechanical lubricator is fitted and the firebox even has small doors situated above the rear wheels, as on the original, for cleaning out that portion of the firebox. The conical effect at the front of the smoke box has also been neatly carried out by means of curved Flexible Plates held in place by a 4 in. Circular Plate. Working brakes are fitted, incidentally.

" The tender is a true copy of the original, the six wheels being made up from Hub Discs and 6 in. Circular Plates, while the leaf springs are all made up from different-length Strips.

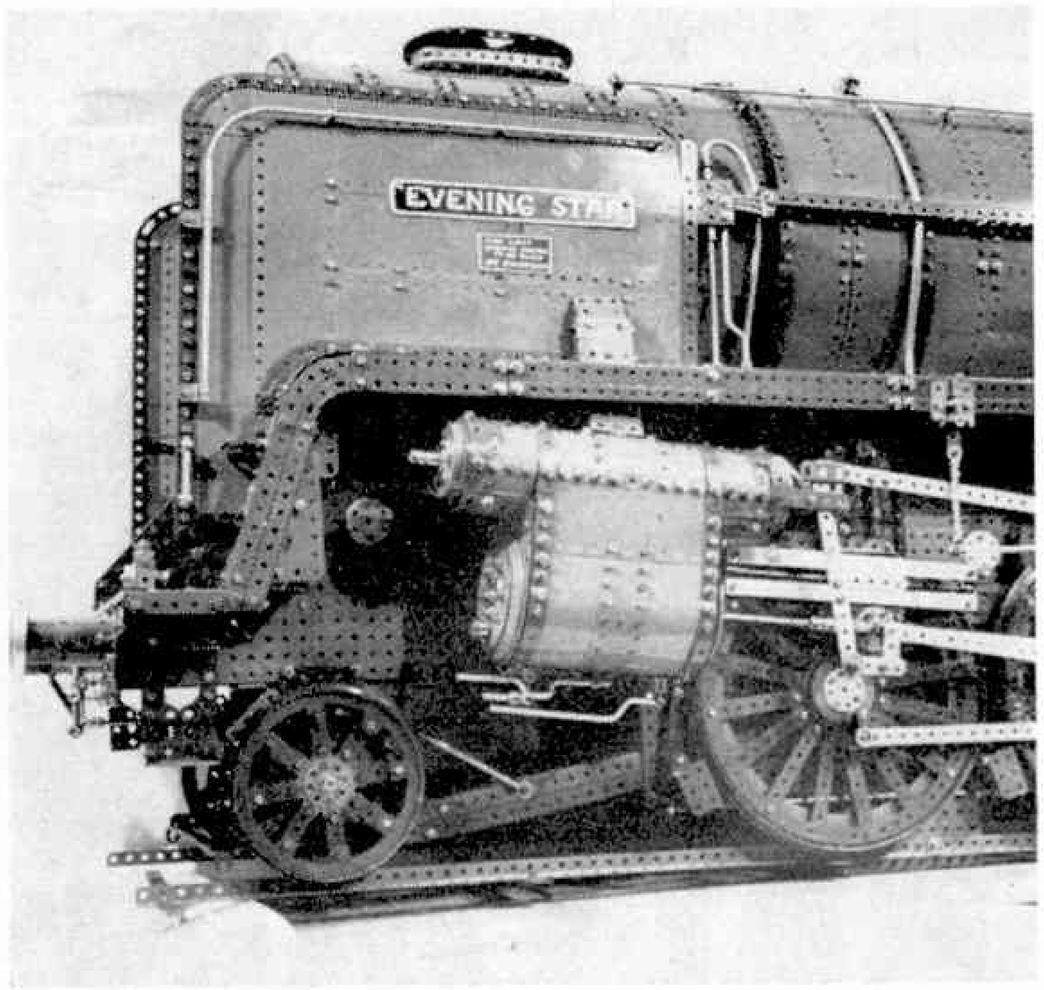
" Other Locos I have built include " King George V ", " City of Truro ", " County of Devon " and the old Broad-gauge Locomotive, " Tiny " which is exhibited at Newton Abbot Station— a few yards away from my house—but I enjoyed building " Evening Star " in particular. I was very impressed by the comparative ease the Meccano parts lined up in such a large model—a tribute indeed to the manufacturing techniques employed by Meccano Tri-ang Limited.

" In conclusion, it was hoped to exhibit the model at Newton Abbot Railway Station, but unfortunately, due to its size and weight, I was unable to get the Loco out of my erecting shed ! After all my forethought with the model, I slipped up on this small item ! "

That's the way the cookie crumbles, Mr. Rowe, but after all, most of the enjoyment is in the building ! Mr. Rowe adds, by the way, that he is quite willing to enter into correspondence with other enthusiasts, so if anybody wishes to contact him, drop a line to Meccano Magazine, Northern Office, Binns Road, Liverpool 13, and I will pass his address on to you.

## Lunar Movement

Featuring " Evening Star " has actually accounted for most of my allowed wordage this month, but I just have enough space left to mention an idea supplied by Mr. Pat Briggs—well known in Meccano circles for his working clocks. It concerns a gear ratio for indicating the phases of the moon and, while it is very simple, utilising only a few Gears and Sprockets,



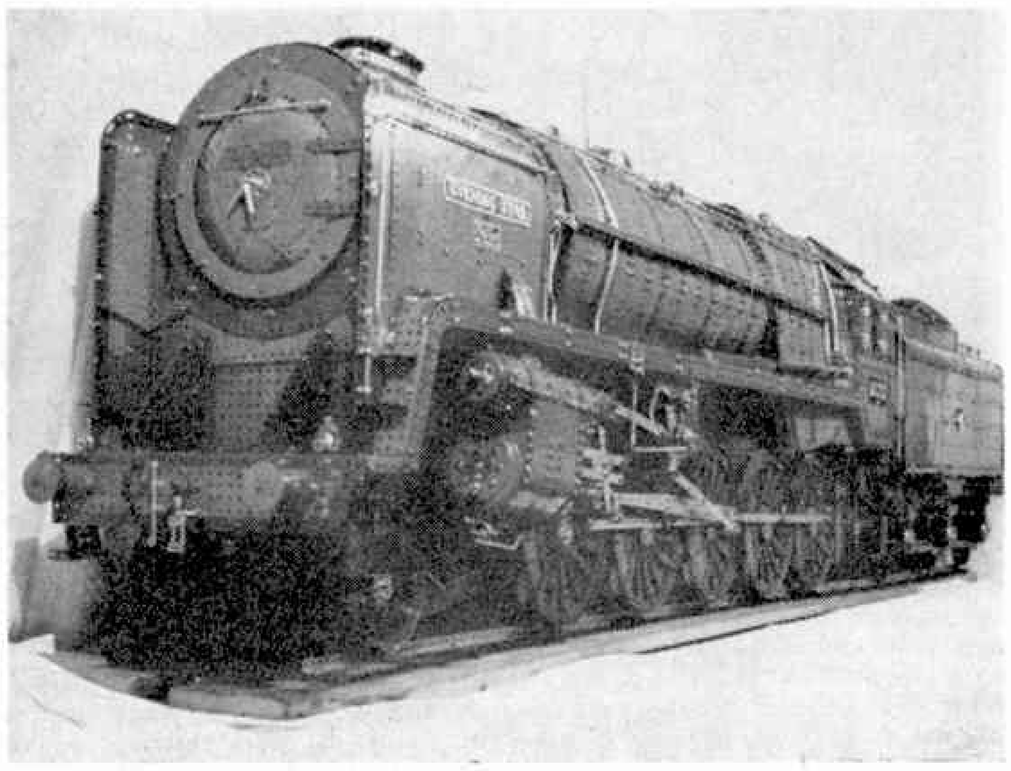

**In this close-up view of the front of the model, the cylinder and valve linkage details are clearly shown.**

it is considerably more accurate than that used in the normal Grandfather Clock.

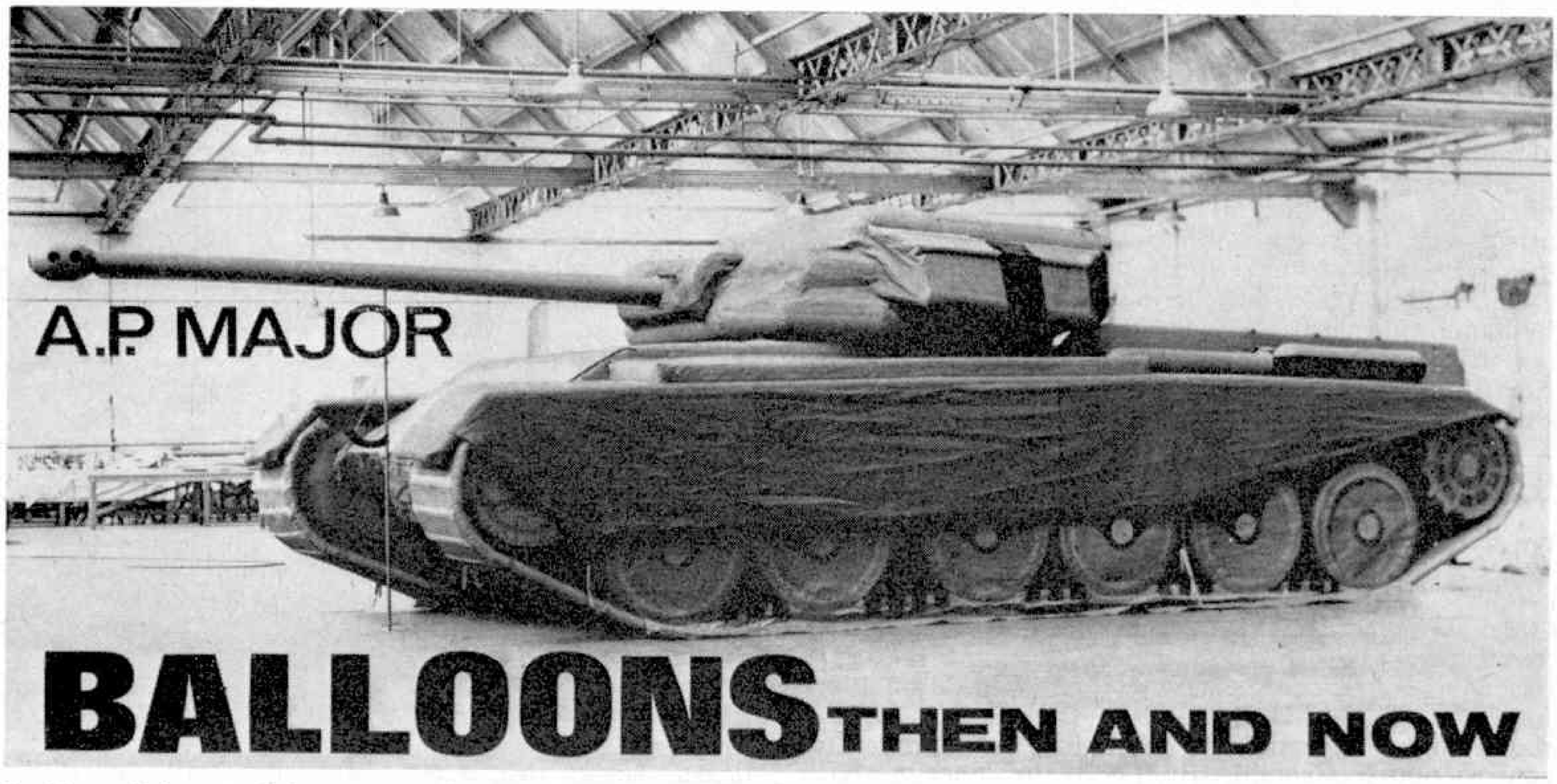
Writes Mr. Briggs : " If it is required to show the age or phases of the moon in a clock movement or an Orrery, the constructor is faced with a fearsome gear-ratio problem. The period from New Moon to New Moon, known as the Lunar Synodic Period, is 29.530389 days, or 29 days, 12 hours, 44 minutes, 2.9 seconds. It is an interesting challenge to design gearing to give a reduction as close as possible to this and, indeed, complete accuracy is possible using Meccano gears in differential and epicyclic forms. However, a very simple, but considerably accurate arrangement is as follows :

$$\textbf{1 rev. per day} \times \frac{\textbf{Worm}}{\textbf{38T}} \times \frac{\textbf{18T}}{\textbf{14T}} = \textbf{1 rev. per 29.56 days.}$$

Hence, with only a few Gears and Sprockets, we have a lunar movement with an error of only 36 minutes (slow) per month."



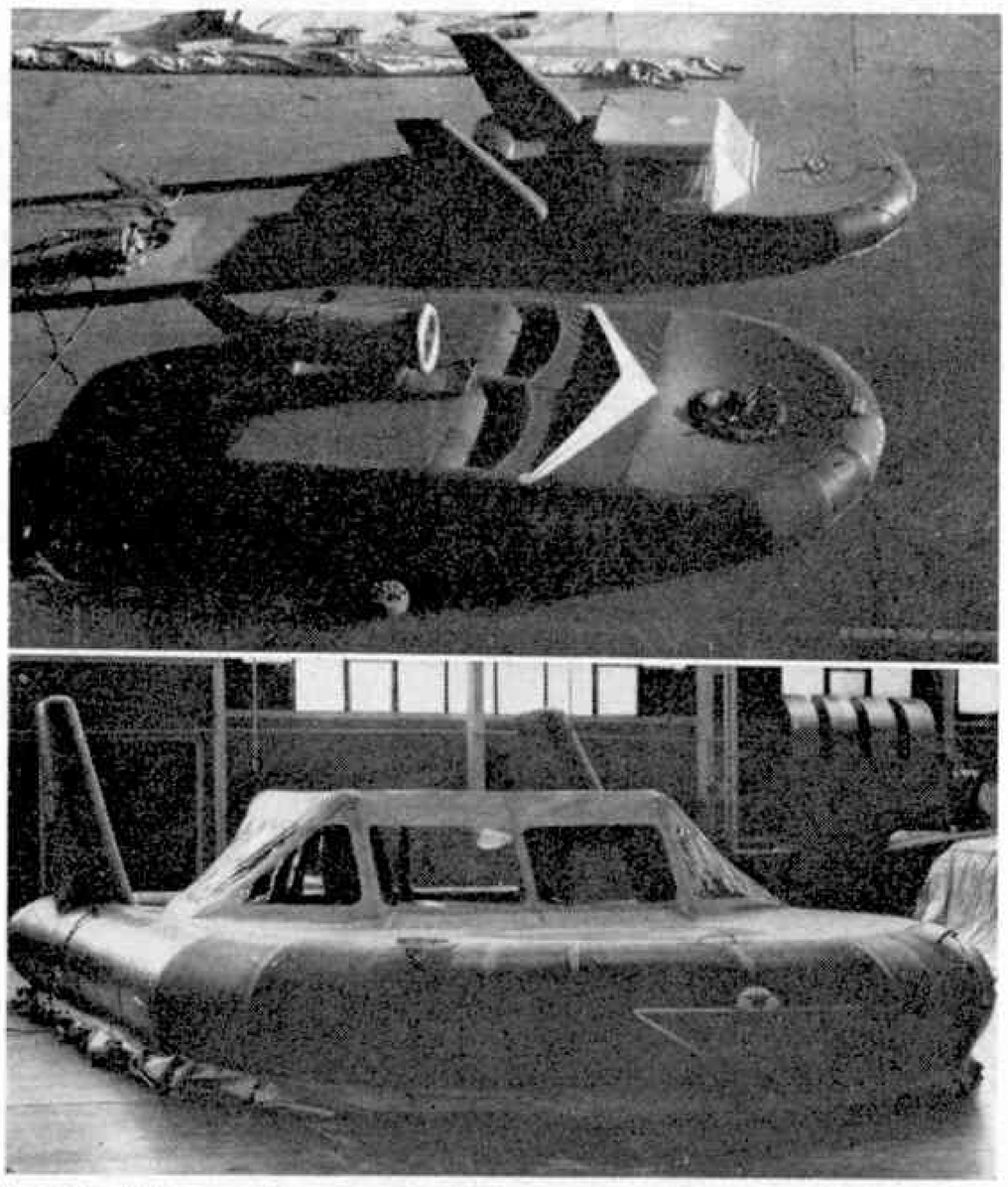
**A very impressive view of " Evening Star " showing how much minute detail Mr. Rowe has managed to build into his model.**




# BALLOONS THEN AND NOW

**Inflatable rubber tanks and Hovercraft are just a couple of unusual uses for air inflated devices. The above photograph shows an inflatable fabric 'Centurian' tank military decoy device.**

SINCE THE FIRST BALLOON was invented almost two hundred years ago this form of air craft has been put to many uses and far from being obsolete now balloons, as inflatable structures, are being found suitable for an increasingly wide range of applications in industry and research.



**Hovercraft are often required to operate in remote areas, but owing to their size it is difficult to transport them over unmade or narrow roads. An inflatable hovercraft can be packed into a small space for storage or transport by air, land or sea; it can also be parachuted. It is light in weight, it is very buoyant, and the inflatable structure is compartmented. There are no corrosion problems. It is easy to maintain and repair. It can flex in a rough sea without structural failure. The rubber structure damps out engine vibration and provides protection for the crew.**

The history of the balloons is as fascinating as that of the aeroplane. Basically a balloon is a lighter-than-air aircraft, not provided with any means of propulsion or steering at the mercy of the weather, wind and air currents, deriving its method of suspension from the gas contained in the gas-bag. The latter is covered with a "net" from which is hung the "basket" in which the pilot and passengers stand or sit. At the bottom of the gas-bag is an elongation or "neck" which is open to the air in order that the gas may escape as it expands during the ascent into the rarified atmosphere. A "valve" is also fitted which may be opened by a cord from the basket when it is necessary to rise. A trail-rope is usually carried which is used in trailing over open countryside or the sea, the rope being allowed to drag on the ground. This has some control over the ascending and descending of the balloon so it stays at a desired height. When the balloon rises it raises more of the rope from the ground, the additional weight bringing the balloon down again. Alternatively, as it descends the weight of the trail rope is taken by the ground and so lightens the balloon. Balloons are usually either constructed of varnished cloth or goldbeaters' skin and inflated in early examples by hot air and since then with hydrogen, helium, coal-gas and propane-gas.

The first ascent by a small unmanned hot air balloon took place in the apartment of Joseph Montgolfier in Avignon, France, in November, 1782. In June, 1783, the Montgolfier brothers made the first public unmanned ascent at Annonay, France, with a balloon made from cloth lined with paper, having a circumference of 110 feet. Like modern space researchers the Montgolfiers used sheep, a duck and a cockerel, sent up in their next experiment with a balloon of their own design, on 19th September, 1783, at Versailles, France.

The balloon landed safely, the sheep and duck were unharmed, but the cock had injured a wing on impact with the earth. However, encouraged by this, the Montgolfier brothers built another balloon in which two more Frenchmen, de Rozier and d'Arlandes risked their own necks and made the first manned ascent, lasting twenty-five minutes, in a hot air balloon at Paris on 20th November, 1783. That they were lucky to escape with their lives was reported in their account of the flight, with both having to sponge out "little fires" on the cloth bag and rigging caused by having to throw straw on the fire in the fire basket, made from wrought-iron wire, and suspended from the bottom of the "neck" by chains. Other balloon enthusiasts instead looked for a different gas and on 1st December, 1783, a Frenchman, J. A. Charles ascended in his hydrogen filled balloon, the bag being constructed from silk cloth made impermeable to the hydrogen by painting it with a rubber solution.

After this records of "firsts" for balloons came thick and fast as ballooning captured the enthusiasm of the public. The first successful ascent in Britain was made by James Tytler at Edinburgh on 25th August, 1784, followed by the first ascent in England, by an Italian, Vincent Lunardi, in a hydrogen filled balloon from Moorfields, London, on 15th September, 1784. On 4th October, the same year, James Sadler rose in a Montgolfier balloon at Oxford to become the first Englishman to do so.

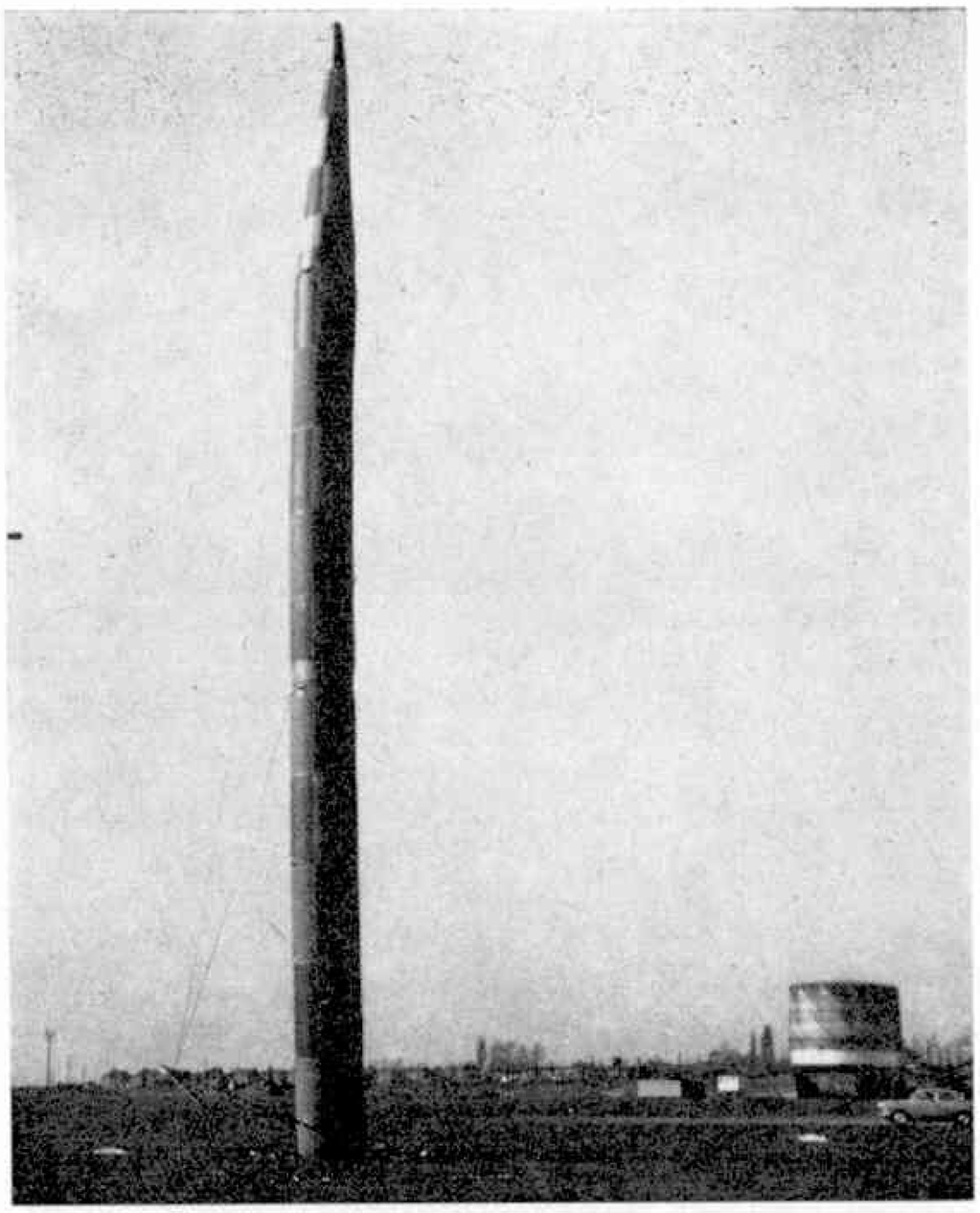
The first air mail letters sent by a craft were carried, enclosed in a waterproof bladder, in the first balloon to cross the English Channel, from Dover to Calais, manned by the Frenchman Jean-Pierre Blanchard and American John Jefferies, on 7th January, 1785. The flight was not without incident in which they had to jettison their own clothes in the freezing weather, as well as everything else movable, apart from a bottle of brandy, in order to avoid coming down in the water.

The first successful parachute descent is believed to be that by a Pole, Jordaki Kuparento, who leapt from his blazing balloon over Warsaw in 1808—and lived.

It was soon realised that balloons could be useful in warfare. On 29th March, 1794, the French established their Aerostatic Corps of the Artillery Service and on 20th June were used to direct tactics at the Battle of Fleurus, which the French won. Another more famous use was at the Siege of Paris, 1870-71 to carry mail, government despatches and passengers in and out of the city. Observation balloons were used in the American Civil War, also by the French, British, and German armies in the First World War. A more recent wartime use of balloons were the captive kite-balloons, known as barrage balloons, moored above cities, towns, vital targets, such as factories and dockyards, airfields, transport ships, as a defensive measure against low level dive bombing attacks.

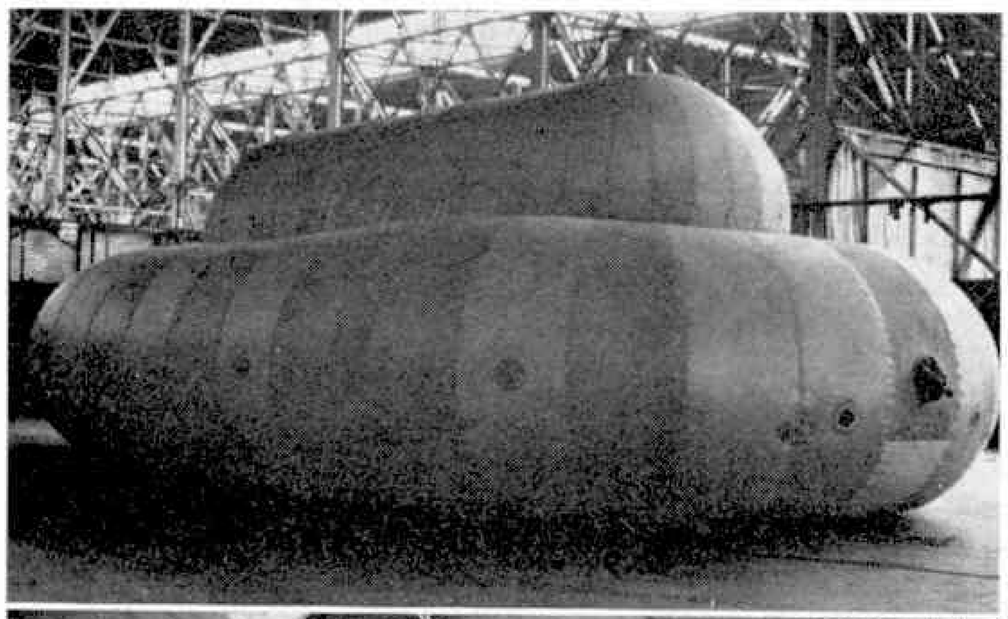
The first ascent of a balloon with an engine, a gas engine, was by Paul Haenlein, at Brunn, Moravia, on 13th December, 1872. This opened up the possibilities of controllable, navigable balloons, better known as airships, which included the Tissandier brothers' electric airship of 1883, the more successful powered Renard and Krebs' airship of 1884, Woelfert's petrol engined airship of 1888, Schwartz' first rigid airship of 1897, Zeppelin's rigid airships of the First World War and afterwards the British R100 and R101. During the Second World War the U.S. Navy used small non-rigid types of manned airships, called "blimps" to patrol their Atlantic seaboard to detect submarines and protect convoys.

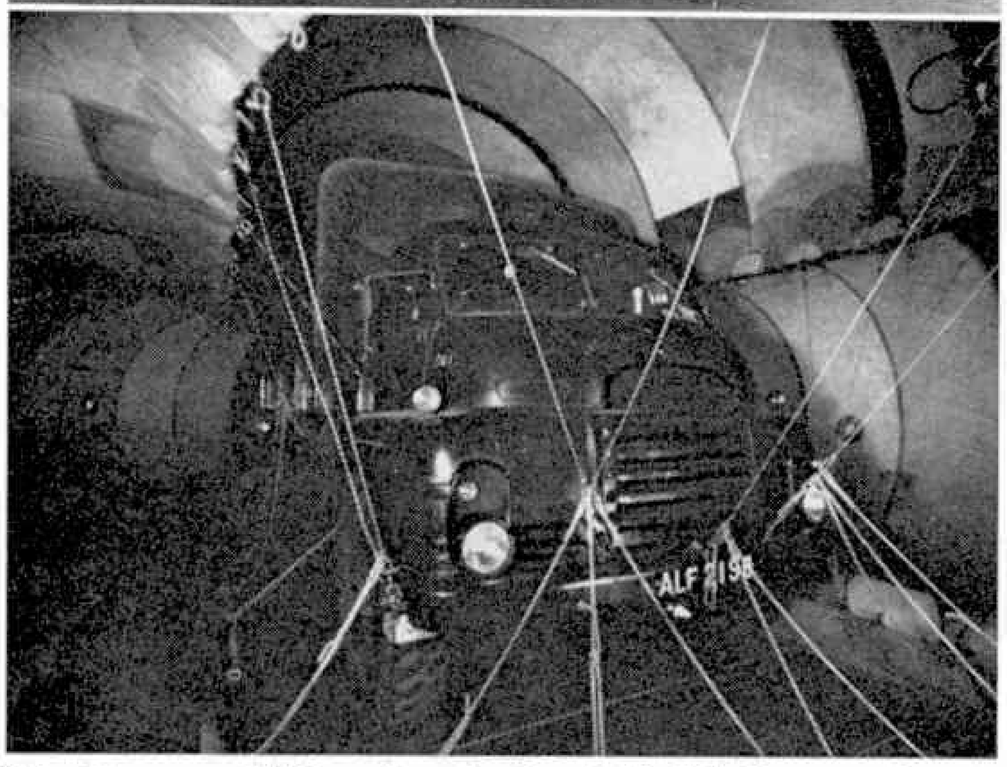
Balloons have proved invaluable in scientific research. One of the early manned experiments was by two Englishmen, Coxwell and Glaisher who, on 5th September, 1862, ascended to seven miles, both men nearly dying from the effects of cold and rarified atmosphere. In 1902 de Bort used sounding balloons to discover the stratosphere, while Auguste Picard's ascent to ten miles in a specially constructed balloon in 1931-32, conquered the stratosphere. In 1935 the huge American balloon, "Explorer II", inflated with four million cubic feet of helium, took a team of scientists with their floating laboratory, to an altitude of fourteen miles. In 1957 a pressurized balloon, with an American doctor on board, rose to nineteen miles above the earth. In August, 1960, an American balloon earth satellite, "Echo I", was launched into orbit thousand miles high by a three-stage rocket.



**100 ft. tall inflatable mast 5 ft. dia.; at base tapering to 1 ft. dia. at the top. Internal pressure 21 lb. sq. in. Designed for use as a track marker for aircraft at low altitude for supporting radio or T.V. aerials. A windsock, light beacon and smoke signals at various sights or could carry a camera.**

**An "air cushion" inflated by the vehicles exhaust raises the rear wheels and acts just like a car jack.**





**This Pressure Lifting Vessel, the "Bubble" comprises an inflated tubular base 2 ft. dia. inflated to 21 lb. sq. in. The centre part of this base can be deflated to form a hinge. To the base is attached a fabric canopy on the roof of which are a series of suspension patches. The base is hinged back and the vehicle or load is driven in. The canopy is hinged over it and the roof suspension wires connected to the load. A blower delivers air through a sleeve to the canopy which inflates and, as the pressure builds up the load is raised, air under the base is prevented from escaping by a short fabric skirt. A point is reached where the craft is just hovering and it can be launched into the water. The vessel can then be used to ferry a vehicle or load over water, marsh, etc.**

Meteorologists and astronomers still send their instruments up in balloons to collect data about the upper atmosphere and in recent years physicists have increased their knowledge of cosmic radiation from the study of photographic plates sent into the upper regions in balloons.

**Inflatable Hovercraft are extremely light in weight. This one, "Kittyhawk", seen more clearly on the preceding page, was ferried on the Editor's car roof to a rally held last year in a local park.**

Balloons and ballooning in other forms is now enjoying something of a revival among enthusiasts, here in Europe and the U.S.A., who enjoy this mode of near-silent travel going where the winds take them. This craft has been on safari across Africa and an unsuccessful attempt has been made to travel over the Atlantic in one. Balloons, as in the past, are being used for publicity; one, painted like the Union Jack, twenty feet in diameter and made in Lancashire, was flown 150 feet above the British Pavilion at Expo 70 in Osaka, Japan.

But balloons also have a more practical use. At the Research and Development Establishment at Cardington, Bedfordshire, where the R100 and R101 airships were built and also "home" of the Air Ministry's Barrage Balloon Units, balloons have been developed for industry and scientific research organisations to provide a unique testing facility, a "sky-hook" as high as 16,000 feet from which equipment can be suspended or dropped to see what happens to the latter. In two gigantic airship hangars items up to a ton can be dropped from various points, on to a concrete floor, into a sand pit or catching net, with cameras angled to film the results. Items tested so far include parachute designs, radar and radio equipment and other instruments. Dropping is done either by parachute or free from a tethered balloon.

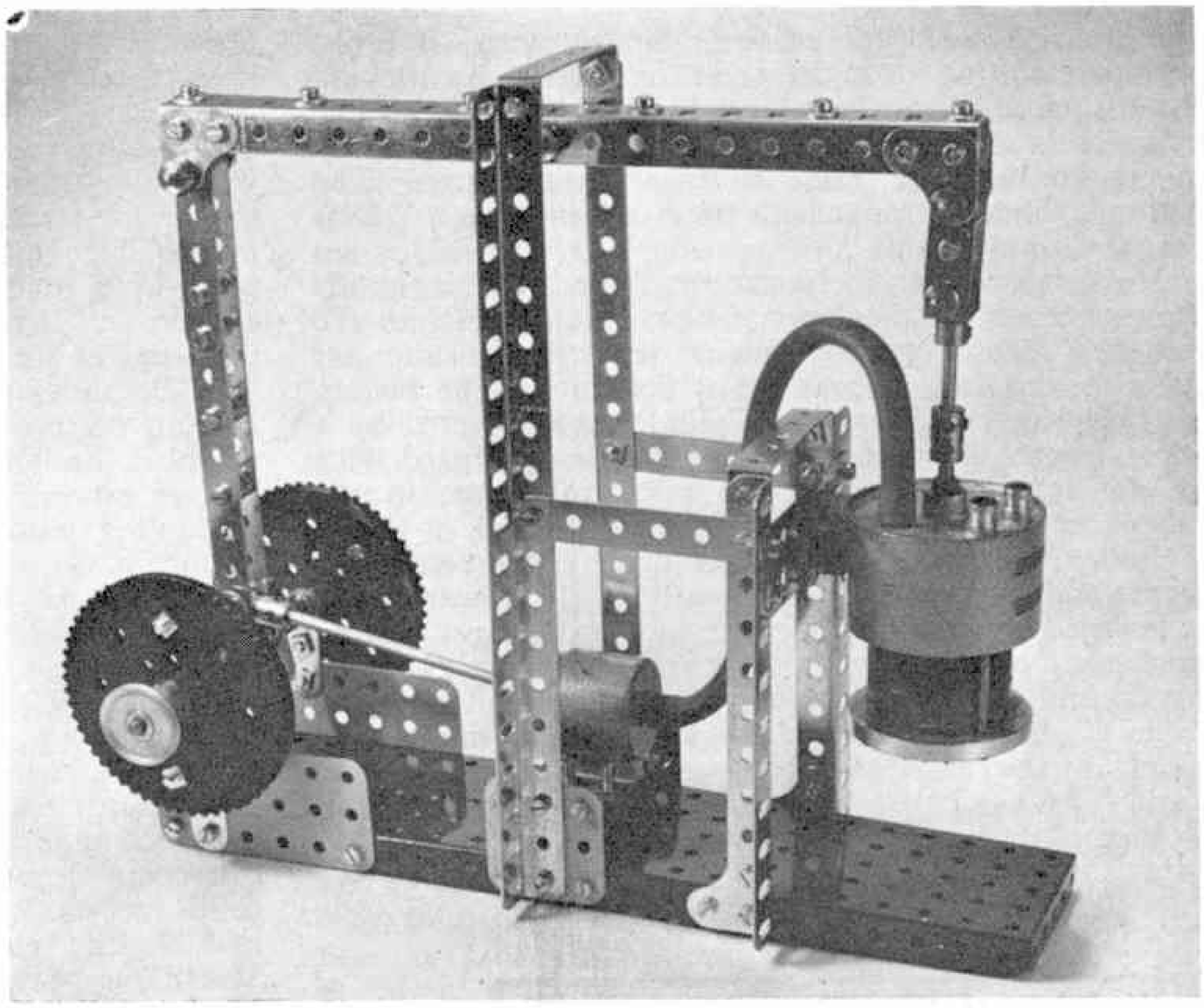
The Establishment is now, through its pre-war and wartime balloon experience, world famous for its techniques in designing, making and flying balloons, this knowledge being devoted to the design and engineering of a number of inflatable products, from proofed fabrics, with a wide range of uses. Textiles used for its fabric engineering are linen, cotton, nylon, terylene, and glass fibre, proofed with rubber, PVC, neoprene and polyurethane, using proprietary adhesives for bonding.

Balloons have been designed and made for agricultural work, checking the occurrence of insects at various heights, crop dusting and spraying, also for fire-watching in forests, traffic control, map making and reading, surveying, photography and filming, whaling, aerial field measurement for air pollution investigations, and in tandem, twin or stacked arrays to lift very heavy loads. This has been applied in the lumber industry for lifting equipment into and logs out of otherwise inaccessible sites.

Other forms of lifting devices used are in reality light weight bags which are simply slipped under a load while they are flat, then inflated, and suitable for this purpose on uneven or soft ground. Up to forty tons can be lifted like this using a multiple-bag arrangement. The pressure, only about 40 kilonewtons per square metre usually required, can come from air cylinders. To lift a vehicle, however, it could lift itself by harnessing its exhaust to the bag. One use for this has been found by Bedfordshire Fire Brigade, in rescue work where speed is essential, such as freeing people trapped under a vehicle, fallen tree or similar, or in collapsed trenches. Other forms of balloon or inflatable structure already having practical uses are temporary aerial masts and bridges, canoes and dinghies, flexible fuel tanks and ships' fenders, storage containers and portable swimming pools, inflatable toys and even yachts. These are far cries from the earlier balloons used as means of transport, but demonstrate that far from being restricted in use there seems no limit to the use inflatable structures can be put and their use is expected to increase rather than decline.

*The author gratefully acknowledges the assistance of the Ministry of Technology in the preparation of part of this article.*

***Versatile Meccano can be used in conjunction with a wide variety of components produced by other companies: one example is explained in . . .***



# A CASE FOR HOT AIR!

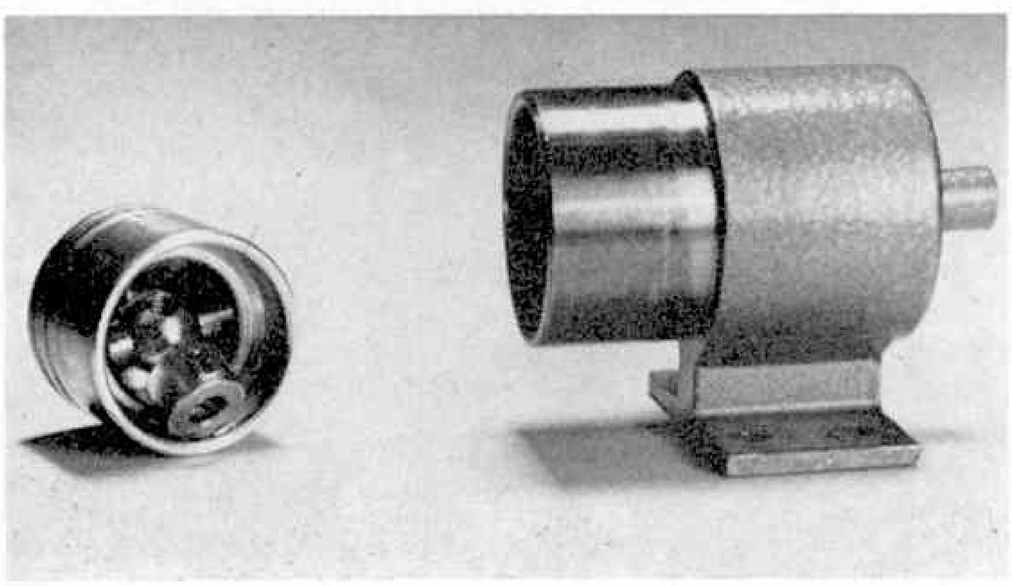
## . . . by Spanner

HOT AIR—I'm sometimes accused of operating on it and I know that some balloons are filled with it, but if you had told me that machines could be powered by it, I would have laughed: which just goes to show how wrong I can be! Power—considerable power—can be extracted from hot air, a fact which I now know after hours of pleasure working with Bradley Hot-Air Engine equipment.

The Hot-Air Engine, it turns out, has been in existence for almost as long as the Steam Engine and, in fact, when I first came into contact with the Bradley equipment featured here, I thought it was steam-operated. In reality, however, there is very little comparison between the two. In a steam engine, water is heated to produce steam, this steam being fed through a valve system to a cylinder and piston. The valve is necessary to cut off or re-direct the steam flow on the return stroke of the piston, thus allowing the piston to return. In a hot-air engine, no steam is created and no valve system is required. The power is simply obtained from changes of pressure resulting from the alternate heating and cooling of a fixed volume of air. It's safer and much cleaner.

To look at the principles behind the Hot-air Engine more closely, it is a known fact that air expands when heated and contracts when cooled. Consequently, if a cylinder of air is heated, the air will expand, thus increasing the pressure inside the cylinder. If the cylinder is then cooled, the pressure will immediately drop as the air contracts. In practice, however, the cylinder is not heated and cooled as a whole, but, instead, only one end is heated while the other end is kept as cool as possible, the air being moved from one end of the cylinder to the other by a loose-fitting " displacer piston " of large volume.

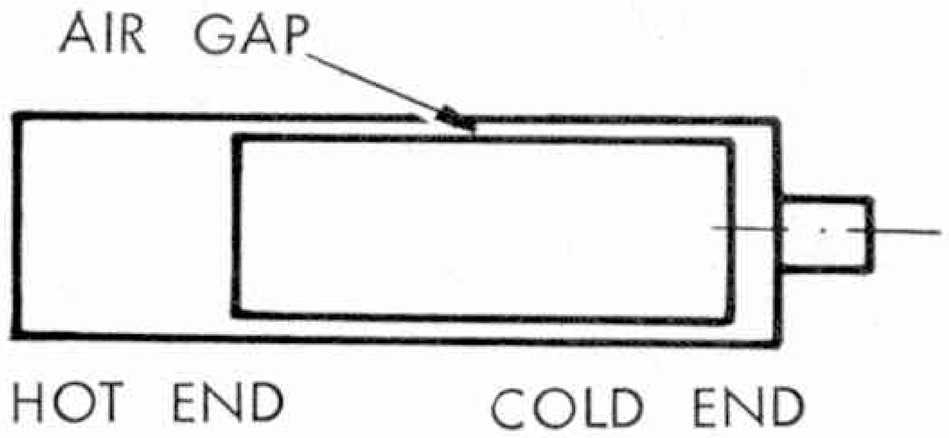
In operation, then, if the displacer piston is moved to the cold end of the cylinder, the air is displaced to the hot end, where it expands and thus increases the pressure inside the cylinder. If the piston is then moved to the hot end, the hot air is accordingly dis-



**The Power Cylinder, with its piston, contained in both Bradley Cylinder Sets reviewed in this article.**

placed to the cold end of the cylinder, where it cools, with a resulting drop in pressure. Thus, by moving the displacer piston back and forth, the air inside the cylinder is alternately heated and cooled, resulting in a regular increase and decrease in pressure. The piston/cylinder arrangement used is known as a " Displacer Cylinder Unit ".

It is important to remember, here, that it is the movement of the displacer piston which results in the rise and fall in pressure inside the cylinder and *not* the rise and fall in pressure which moves the piston. If, however, the Displacer Cylinder is connected by a short length of tubing to another cylinder fitted with an air-tight piston, then the pressure-change in the Displacer Cylinder will act on the second, " Power Cylinder ", as it is called, and drive its piston backwards and forwards. Consequently, if the power piston is coupled by suitable linkages to the displacer piston, movement of the power piston will drive the displacer piston and thus a continuous drive will result once the " cycle " has been started by an external means—by hand in the case of model equipment. The power created is harnessed by connecting the power piston to a crankshaft, from which a drive can be taken.




**A simple Displacer Cylinder.**

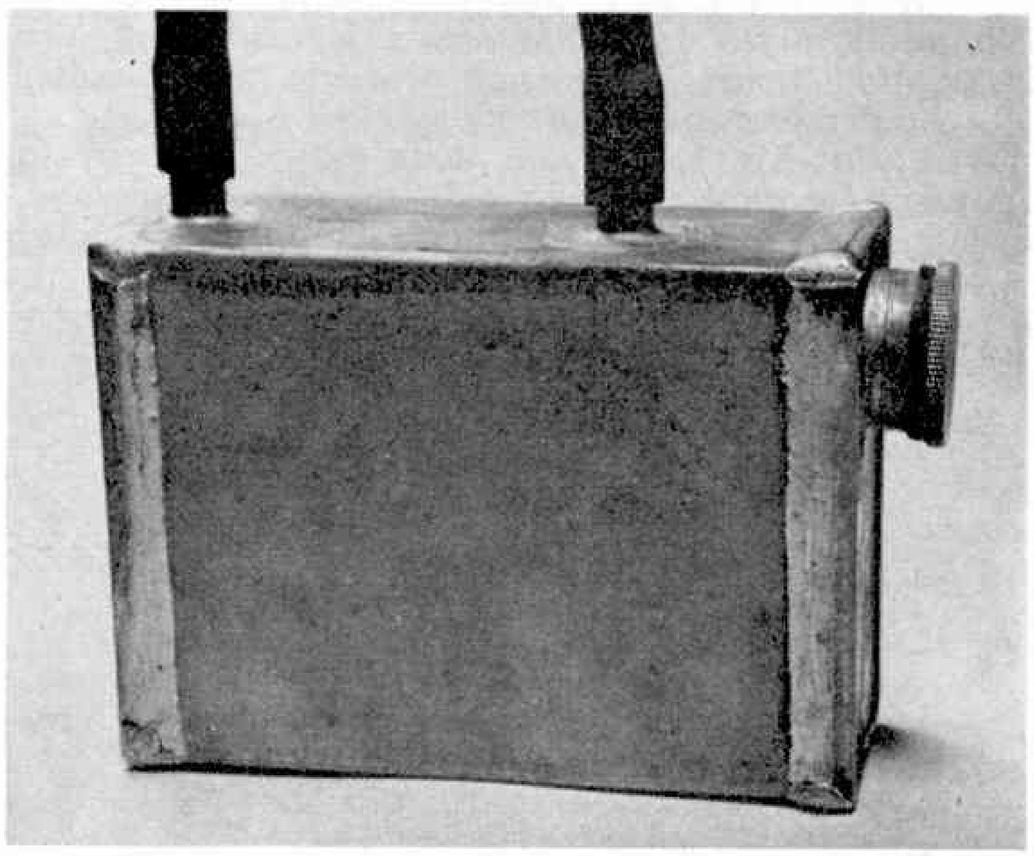
Having looked at the basic principles of a hot air engine, we can now look at the particular equipment featured here. This will be of particular interest to the Meccano modeller, perhaps more than to any other type of modeller, as it is produced primarily, although not exclusively, for use with Meccano. Manufacturers are Bradley Engineering, Precision Engineers, 147 Knoll Drive, Styvechale, Coventry CV3 5DF and the equipment in question comes in the form, not of a " finished " Hot air Engine, but as two separate Cylinder Sets, each Set containing a Displacer Cylinder and a Power Cylinder plus rubber connecting tube and Molyslip lubricant.

On the surface, this collection of components—as opposed to a " finished " engine—might appear as a draw-back, but in actual fact the advantages to a Meccano modeller are tremendous. Because the equipment is designed with Meccano in mind, with the fixing points and connecting rod centres placed at standard $\frac{1}{2}$ in. spacing, the actual engine can be built up from standard Meccano parts. For the Meccano modeller, this means that not only does he have the enjoyment of building up the model to be powered, he also builds up the power unit! Throughout the history of Meccano, non-working models of Beam Engines, Marine Engines; all sorts of Engines have been built at regular intervals to illustrate the movements of their respective prototypes, but never before, except in the case of one or two weak " electric engines ", has it been possible to use these machines for powering purposes. The Bradley Cylinder Sets therefore add a new dimension to serious Meccano modelling.

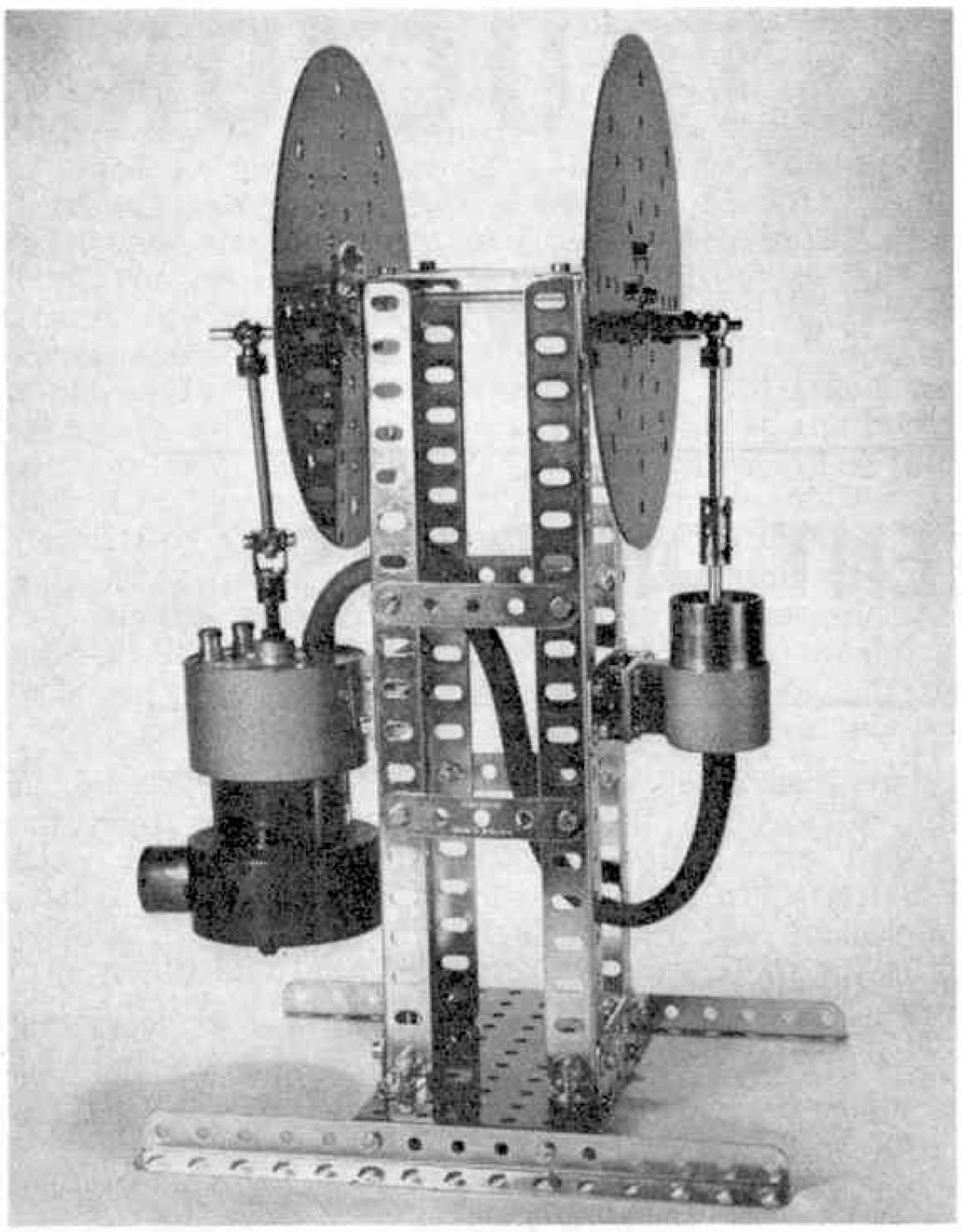
The two Sets kindly loaned to us for test by the manufacturers are officially known as the Bradley Hot-Air Engine Cylinder Set Type 1 and Type 2. Both types contain similar lubricant, connecting tubes and Power Cylinders, the latter with a 1 in. diameter, $1\frac{5}{8}$ in. long (approx.) bore, made in brass and carried in an alloy casting. The piston is aluminium and has a maximum stroke of 1 inch. The Displacer Cylinder in the Type 1 Set is a beautifully-produced item some 3 in. long, made in steel with a cast alloy water-jacket at one end for cooling purposes and a special alloy base at the other end, designed to receive the heat. The Displacer Cylinder in the Type 2 Set is basically similar except that it is fitted with a special heating chamber designed to take more heat and thus give greater power.

Cooling with both Displacer Cylinders is achieved by ordinary cold water carried in the water jacket. A " jacket-full " is sufficient to start an engine working, but the water will soon heat up, therefore, to keep the engine running for any length of time, an additional supply of water is required. This can easily be supplied by a water-hopper or header-tank connected to the water-jacket inlets. A suitable small header-tank loaned to us by Bradley Engineering is shown in the accompanying photograph. Heating for Type 1 can come from a variety of sources: a meths burner; solid fuel tablets such as those sold under the name of " Nesbit "; a small gas blowtorch such as a Ronson Varaflame or a Taymax Butane Pencil-flame Burner—in fact, anything that gives a good heat. The Type 2 Cylinder, however, with the heating chamber, is designed to accept the heat produced by the Taymax Burner and this heat source should be used when maximum power is required. Bradley Engineering can supply the correct lamp at £3.5.0 plus postage.

Ashamed as I am to admit it, I must confess that I was completely unaware of the existence of Hot-Air Engines before my introduction to the Bradley Cylinder Sets. You can imagine, therefore, that when I came to test them, I was starting from absolute scratch, with no experience to draw on. However, by carefully following the guidelines in the literature supplied with the Sets, and beginning with the simplest of Heinrici-type engine designs, I managed to produce a successful —albeit ricketty—engine with no trouble at all. The first ever Spanner-built Hot-Air Engine is shown in the accompanying photograph and although, I know,



**The header tank kindly loaned to us by Bradley Engineering for connecting to the water jacket inlets of the Displacer Cylinders. Although small (4 in. x 3 in. x $1\frac{1}{2}$ in.), it enables an Engine to operate for an extended period of time.**



**The first ever Spanner-built Hot-Air Engine—a simple Heinrici over-crank unit, seen here fitted with the Type 2 Displacer Cylinder. Note the difference between this Cylinder and the Type 1 item.**

it looks terrible, it's surprising how well it worked. It took only a little adjusting of the crank positions in relation to each other and some concerted fly-wheel flicking before it chugged merrily into self-propelled life ! I can honestly say that few sights have pleased and satisfied me more than that model working successfully and, knowing how I had literally " thrown " the Meccano parts together, the fact that it went at all says a great deal for the Bradley equipment.

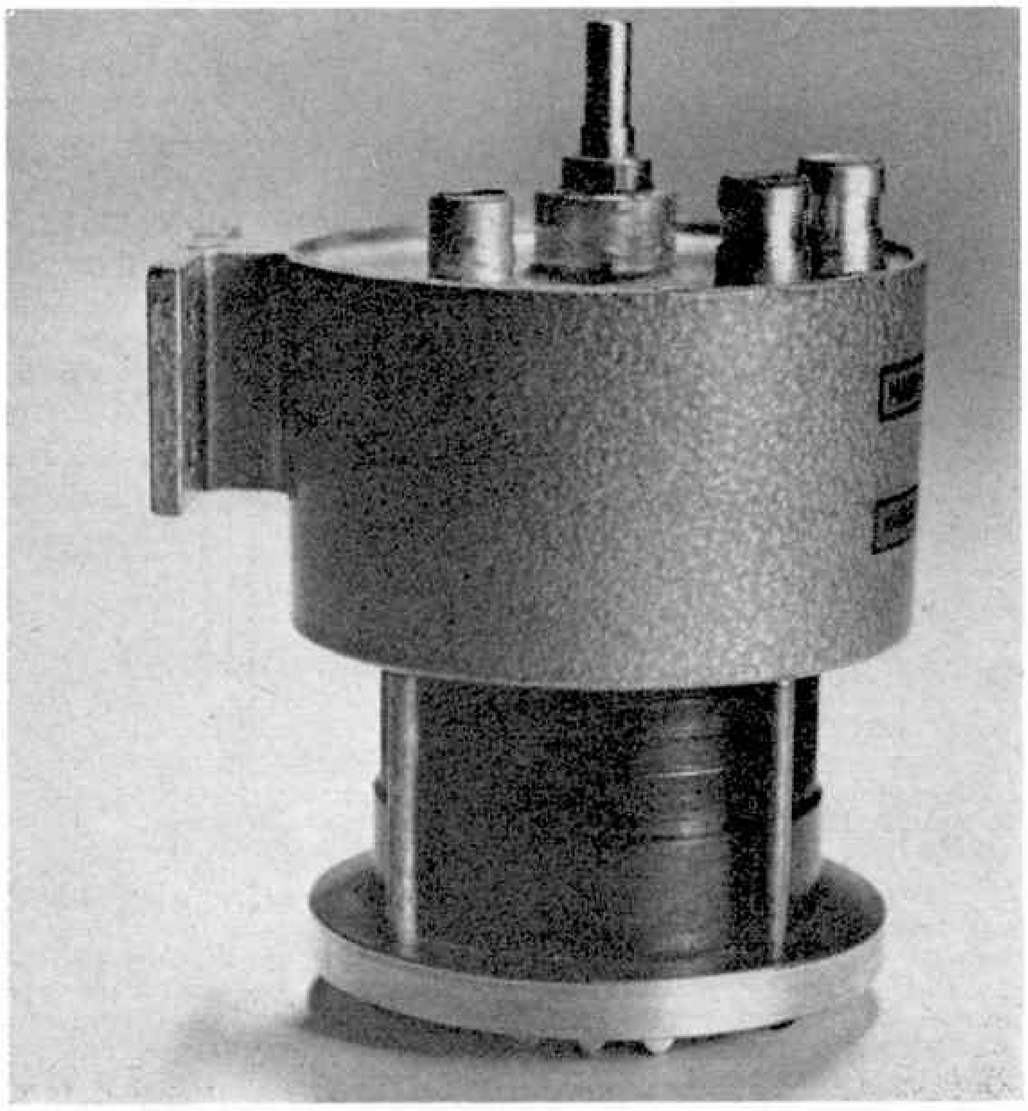
Having satisfied myself that the equipment worked, I next built a simple Beam Engine. Again, my Meccano modelling left a lot to be desired, but I was nonetheless amazed, not only by the model's successful operation, but also by the excellent torque at the crankshaft—considerably more than imparted by a small model steam engine and quite adequate when geared down, to drive most Meccano models. In both constructions I first used the Type 1 Displacer Cylinder, but subsequently replaced this in the Heinrici engine with the more powerful Type 2 Cylinder, with a resulting increase in torque. It should be mentioned, though, that, because of the fairly large size of Meccano-built engines using the equipment, the engines themselves are suitable for use, not with small models, but rather with the larger type of Meccano model such as the Display Model Showman's Traction Engine featured in the M.M. last year. In fact, I did hope to fit an engine into this model, but the particular example featured in the Magazine has been dismantled and no other was available. Even without trying it, however, I have no doubt at all that a Hot-Air Engine using the equipment described would have powered the model without any trouble.

The operating speed of an engine using a Bradley Cylinder Set is between 300 and 1,000 r.p.m. and a particularly interesting and useful feature is that the speed, itself, can be controlled simply by a clamp on the rubber tubing connecting the Displacer and Power Cylinders. Unfortunately, I do not personally have any performance figures of an engine, but the following examples taken from Bradley literature will give you a good idea of what results can be expected:

(1) " A Beam Engine constructed entirely from Meccano with water-hopper cooling, and fired by a half-tablet of " Esbit " solid fuel, provided enough power to drive a small generator; The electrical output was used to run a small motor."

(2) " A Heinrici vertical over-crank engine constructed from Meccano with the exception of the crankshaft, which was mounted in ball races, and fired by a Ronson Varaflame Blowtorch, provided enough power to drive a small lathe, taking light cuts on ½ in. dia. brass bar. A direct rubber belt drive was used, without the use of back gearing. The lathe spindle speed was 600 r.p.m., the engine speed 700 r.p.m."

A final point that must be remembered is that the Bradley Hot-Air equipment is aimed at the serious modeller, the component parts being precision-made, genuine miniature engineering items—definitely not toys. As such, they are costly to produce, this cost naturally being reflected in the retail prices of the Cylinder Sets. The cheaper Set, Type 1, is obtainable from the manufacturers at £8.0.0, plus postage, while the more expensive Type 2 Set sells at £10.0.0, plus postage. The Cylinder Sets, by the way, are not the only hot-air equipment from Bradley Engineering, but they are of the greatest use from a Meccano point of view. I, certainly, was tremendously impressed with them and do not hestitate to recommend them to the model engineer.



**A close-up view of the special Displacer Cylinder included in the Type 1 Bradley Hot-Air Engine Cylinder Set.**

# MECCANO CONSTRUCTORS GUIDE by B. N. Love

## PART 6: MOVEMENT ON RAILS

Engineers are frequently concerned with the question of moving equipment over rails and the rail systems used may be considered either as permanent or temporary roadways of a special kind. Readers are familiar with the 'permanent way' consisting of thousands of miles of railway lines all over the country, but other permanent rail systems are to be found elsewhere—principally in dockyards, where giant cranes move from one end of the dockyard to the other on very strong rails which are usually permanently set in concrete. Tram tracks, unlike the railways, have to be sunk below road level, where normal traffic is flowing, so the rail section has to be grooved rather than flat topped or "bullnosed" as permanent railway track usually is. In the same way, if it is necessary to have movement of other vehicles in a dockyard, sunken rails for the cranes are again essential and the type of wheel for the different tracks has to be designed for the purpose.

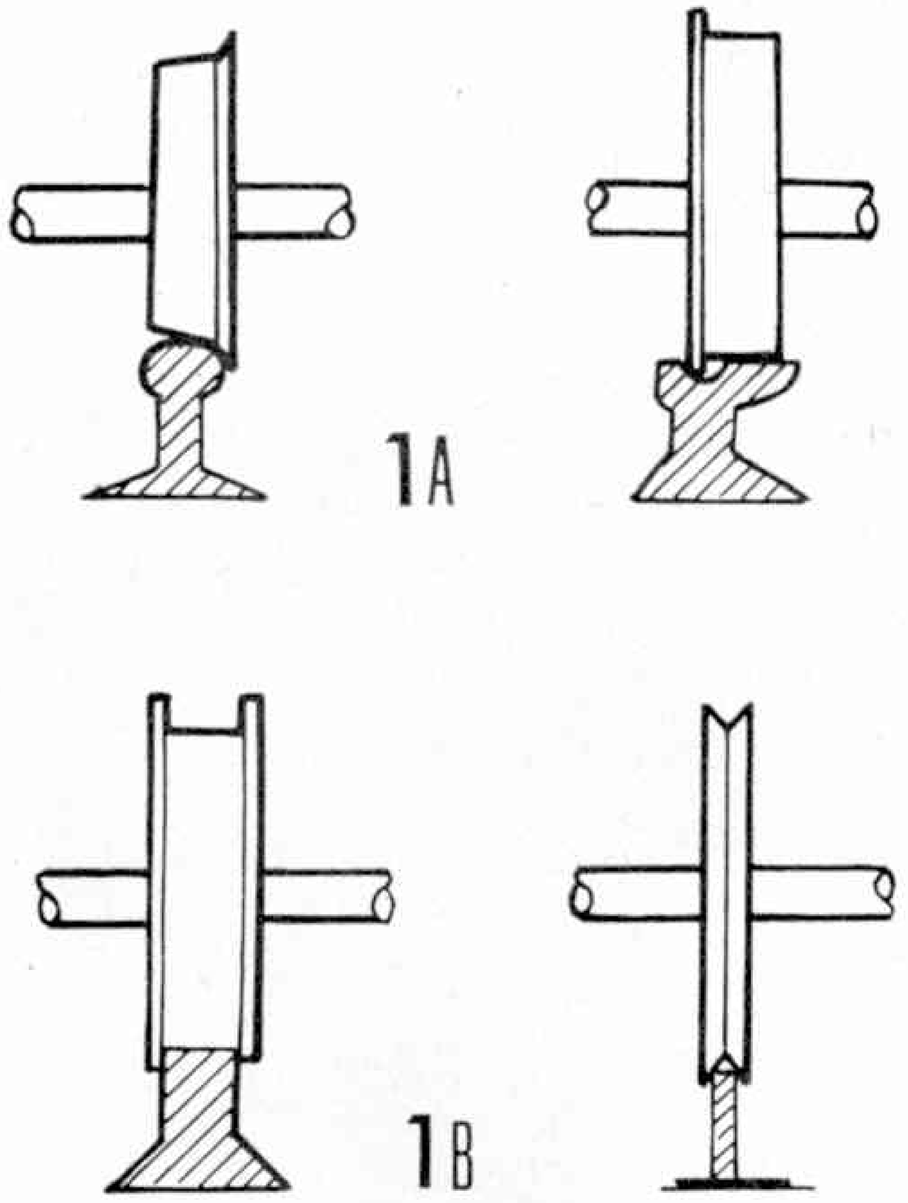



**Fig. 1 (a): Diagram showing a section through two types of rail frequently used in transportation. At left is the common railway line, its appropriate wheel having a tapered-face "tyre" which centralises the wagon shafts between rails and allows for different rail radii when "banking" on a curve. At right is a typical tramway rail secton, but a bevelled face wheel is often required where sharp radii curves are met with. Fig. 1 (b): Two further rail sections. The rail, left, has an almost square top, the double flange of the wheel maintaining its location. The simple rail, right, is useful in simple models and for some internal running gear in larger models.**

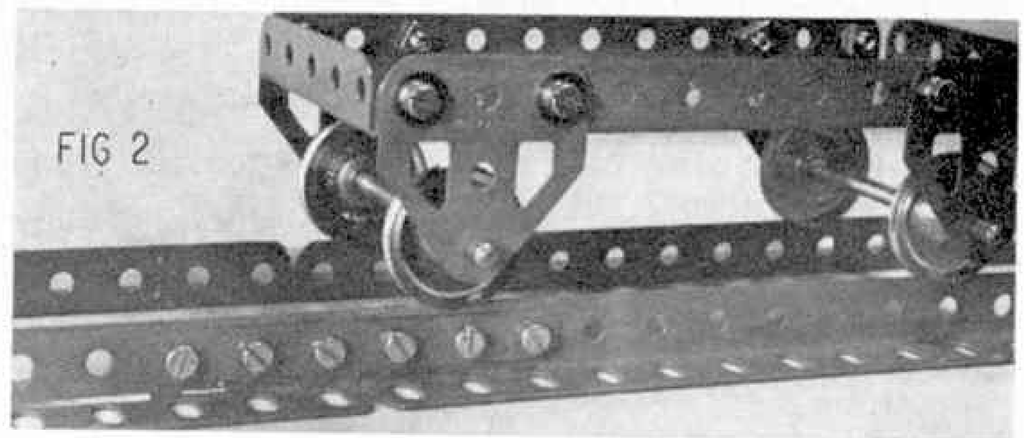



**Fig. 2: A simple method of making a none-bulge joint in strip rails for pulley wheel running gear.**

The Meccano system lends itself very well to the building of models which run on tracks and its wide range of wheels and wheel discs gives tremendous scope to the modeller. Fig. 1(a) shows, basically, the two types of rail section found in engineering practice, while Fig. 1(b) shows two further types suitable for models as well as some aspects of other machinery. All four types are readily made with Meccano parts and the simple rail, illustrated in Fig. 1(b) can be made from Perforated Strips mounted on edge, or from Angle Girders, as shown in Fig. 2.

The equally-simple rail truck in Fig. 2 runs very well on the track shown, so long as continuity of rail joint can be maintained. This can prove difficult when using pulleys as rail wheels but the solution is shown in the illustration. A non-bulging rail joint is achieved by butting the two ends of the strips or Girders forming the rail and overlaying the joint on each side with electrical 2 in. Brass Strips, Part No. 530 and then adding two Narrow Strips, Part No. 235a, as reinforcement. When bolted up tightly, the join is very strong and pulley wheels will run over it quite smoothly. Note the "bump" spot on the far side caused by the curved ends of the Girders.

There are occasions when the engineer is faced with having a very heavy machine, like a Dragline, working on a soil face or even sand. In such cases, the terrain has to be levelled as far as possible and temporary tracks laid out. Care will be taken to maintain uni-

formity, but means is provided in heavy machines to compensate for vertical movement of temporary tracks on soft or shifting ground. Fig. 3 shows two views of a Dragline bogey, which would be one of four, mounted at each corner of a dragline. This would distribute the weight over a total of 16 wheels and the bogies would run on two sets of twin tracks, one length of which is shown in Fig. 3. This particular design of bogey truck utilises the double flanged wheels and flat-topped rail shown in Fig. 1(b), normal Meccano $1\frac{1}{8}$ in. Flanged Wheels being used and fitted with 6 or 8-hole Wheel Discs on one side of the bogey and 50-teeth Gear Wheels on the other. The flat topped rail is made from three thicknesses of Perforated Strips sandwiched between Angle Girders.

If such a track is used for a model dragline, the twin rails should be spaced accurately by the use of Perforated Strips and then cross-connected to the other twin rails at the other side of the model to suit its width. Spacing strips can be avoided if the whole set of rails is screwed to a base-board.

It will be noticed from the illustration that the bogey truck has a Handrail Support, Part No. 136, screwed into the top of a Channel Bearing, to which double thicknesses of $2\frac{1}{2}$ in. Flat Girders are attached with Nuts and Bolts, reinforced with Washers for a secure grip. The Flat Girders give adequate strength and serve as bearings for the Axle Rods carrying the double-sided flanged wheels, while the Handrail Support acts as part of a "Ball and Socket" joint.

Since the temporary rails over which a heavy dragline would work are subject to displacement, the bogey trucks must be able to "ride" up and down a little, the two rear ones being mounted at either end of a heavy compensating beam, pivoted at its centre to the rear of the dragline platform. The beam and the forward part of the superstructure would carry four Socket Couplings, Part No. 171, pointing downwards to take the heads of the Handrail Supports. A short length of Spring Cord, Part No. 58, gripped in the cross bore of the Handrail Support by double Grub Screws, will also pass into the tapped holes at the bottom of the Socket Coupling. This will give a flexible joint which can stand considerable downward pressure but will not fall apart if the model is lifted bodily. The Socket Couplings would, of course, have to be securely attached to the superstructure of the dragline.

Fig. 3a shows the under view of the bogey trucks, where the Sprocket Chain drive and 25-teeth reduction Pinion can clearly be seen. In operation, the chain lies in a slightly sagging loop to accommodate any rise or fall in the bogey trucks, this being as acceptable as in the prototype because of the slow speed of operation of such gear.

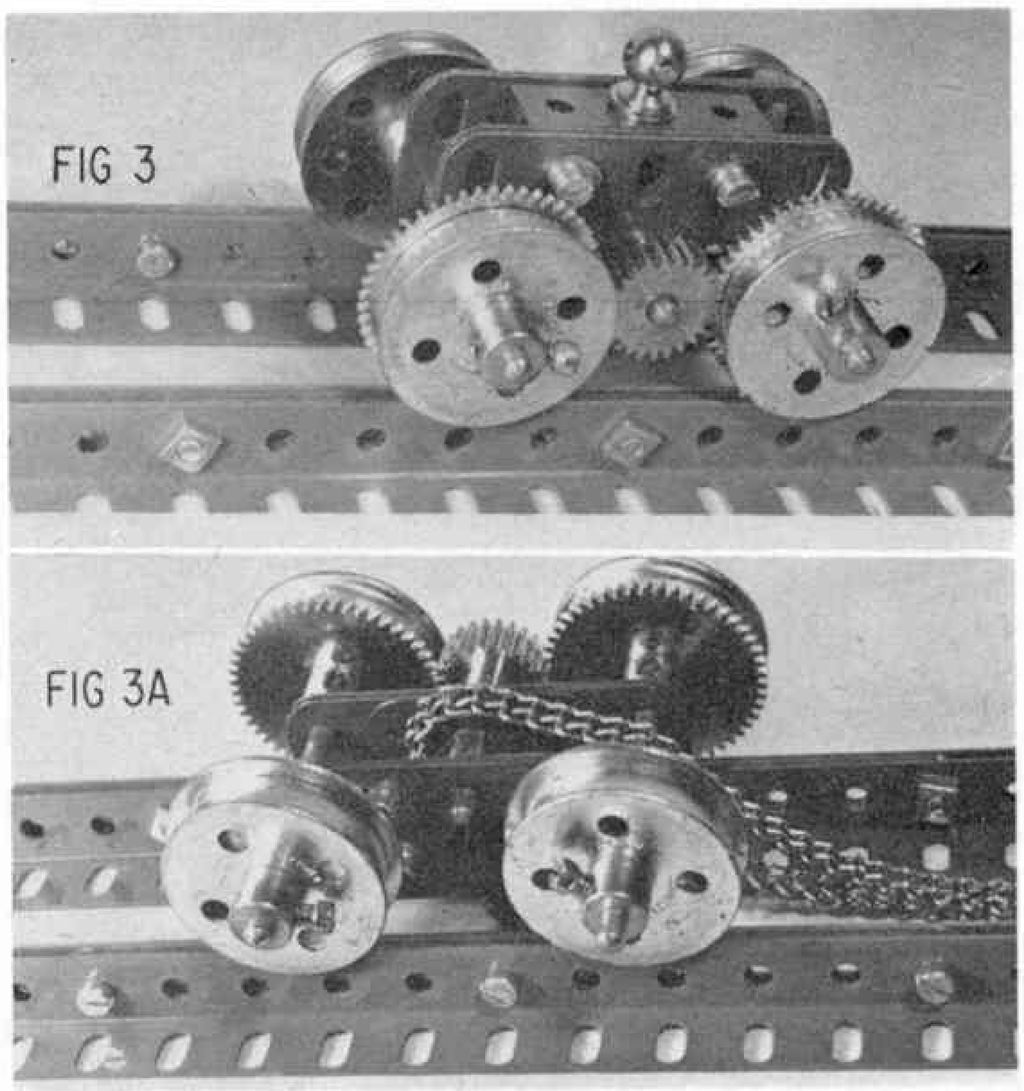
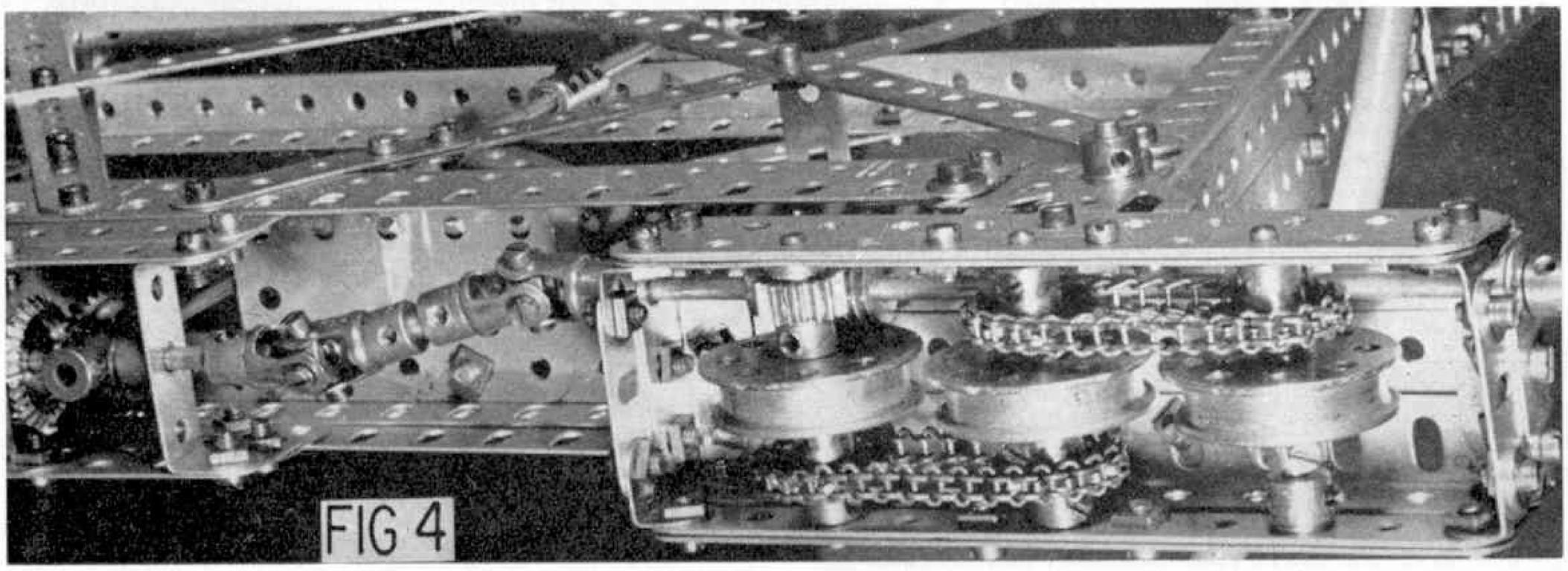


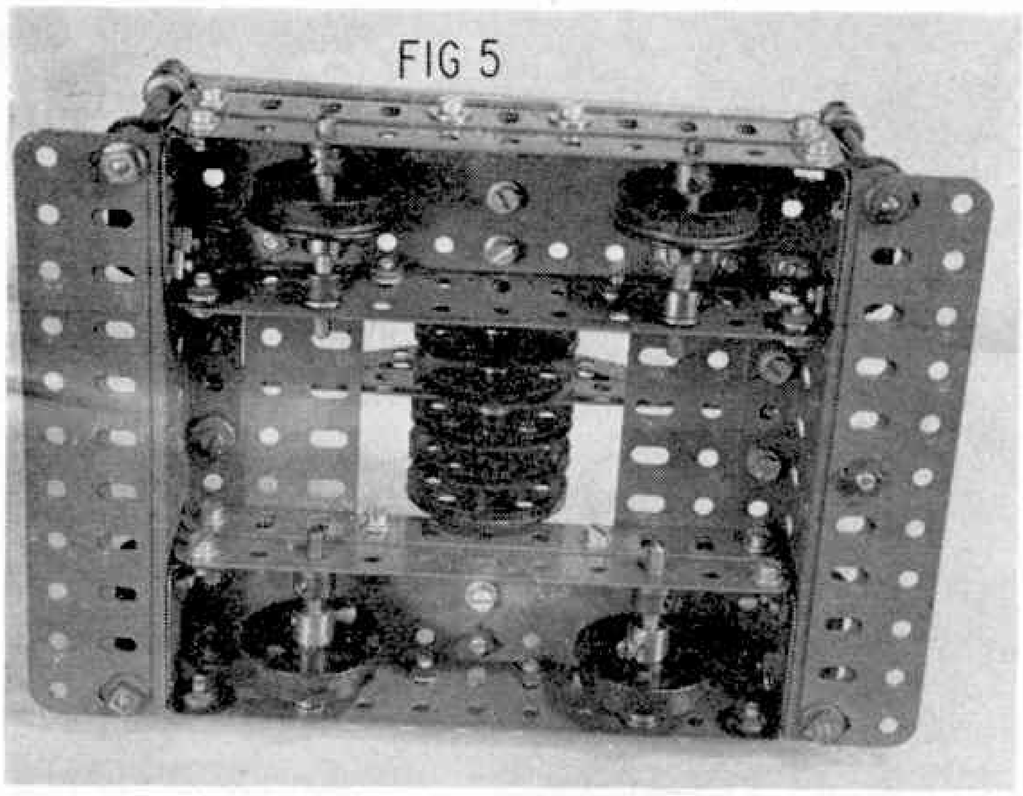

**Fig. 3: Dragline bogey truck with double flanged wheels and flat-topped rail. Handrail Support at top forms lower part of "Ball and Socket" joint with Socket Couplings attached to superstructure.**

**Fig. 3 (a): Lower view of dragline bogey showing spur gear drive to travelling wheels via Sprocket Chain. Chain drive runs in a slack loop at low speed and accommodates rise and fall of bogey over uneven rail sections.**

For the locomotive building enthusiast, Meccano Flanged Wheels provide a ready-made item for track working and Fig. 10 shows how they are put to good use in the construction of a self-contained locomotive bogey. The perforations in the Flanged Wheels take standard Meccano Bolts or Pivot Bolts so that connecting rods, made from $2\frac{1}{2}$ in. Narrow Strips, can be attached as shown. Cylinders are provided by Couplings, Part No. 63, housed in a pair of Chimney Adaptors on either side of the truck and a drive is imparted to the wheels via 1 in. Gear Wheels meshed

**Fig. 4: Travelling arrangements, for the advanced modeller, having a number of advantages over simpler designs. Note Worm drive and compact positive drive to all axles.**





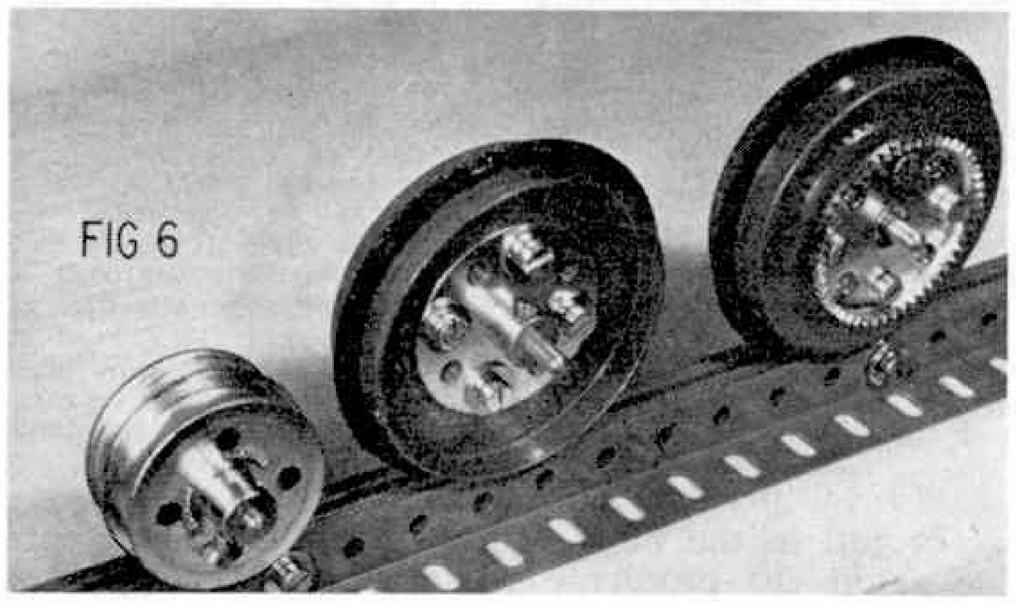




Fig. 5: Heavy duty " crab " trolley for giant Block-Setting Crane making use of independently-mounted Flanged Wheels for maximum axle strength.

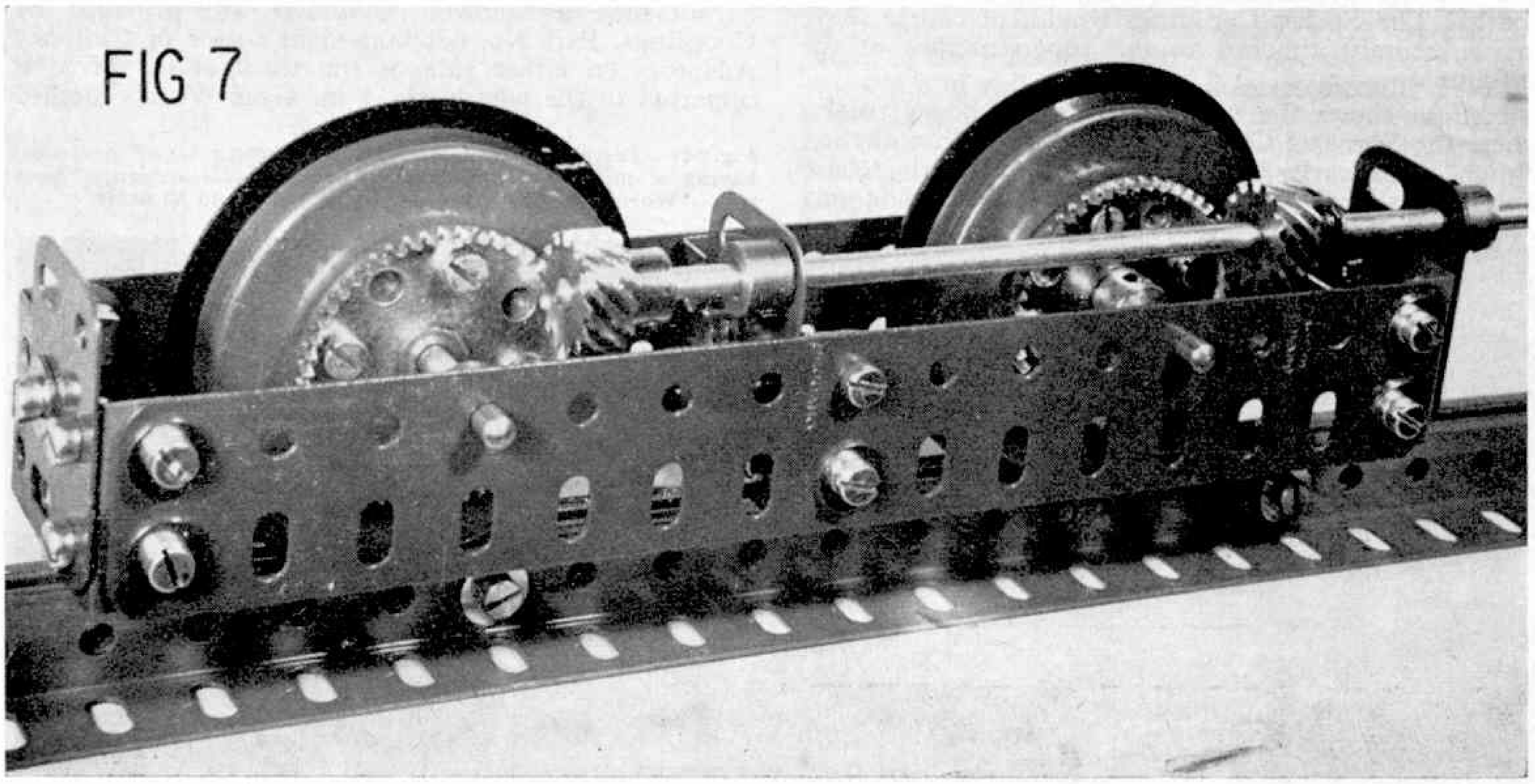
Fig. 6: Built-up travelling wheels with centre flange and wide surface contact suitable for heavy machinery. Note recess in centre of flat-topped rail. The extra thickness of strips is divided in the centre and spaced by a Washer, nut or twist of Meccano Cord to accommodate depth of centre flange.

together, the centre shaft receiving its drive via a $\frac{3}{4}$ in. Pinion and Contrate Wheel. The shaft carrying the $\frac{3}{4}$ in. Pinion also forms the pivot for the bogey truck when it passes up through the boiler platform of the locomotive. Although the front axle carries a Coupling, this is simply to join two short axles, to make use of available parts at the time of building, but a $2\frac{1}{2}$ in. Axle Rod may be used instead.

A further application of the standard Flanged Wheel is shown in Fig. 5 which illustrates a heavy duty " crab " truck used on a model of a Giant Block-Setting Crane. As this crab takes a considerable load of genuine stone, it is built to rugged proportions with adequate strengthening from Flat and Angle Girders. All four rail wheels are mounted on independent short axles to relieve bending strains and to keep the centre section of the crab clear for the fall of the hoisting ropes. This is a case where the engineer is concerned with internal rail running which is a feature of many items in the engineering field. The crab illustrated runs on a set of rails mounted rigidly to the boom of a crane, but in many other machines—particularly interesting textile machines—integral portions of the machinery oscillate on rails, sometimes over considerable distances, and quite often the running wheels are of simple grooved or pulley form.

As machinery gets heavier, to handle greater loads, the wheels on which such machines are carried must be proportionately increased in size and strength. A Gantry crane capable of straddling 200,000 ton oil tankers in shipyards has now been installed in a British shipyard and, as might be expected, its travelling wheels run on flush or sunken rails and make use of centre flanged wheels which present a wide surface to the rail contact point. Samples of such wheels are illustrated in Fig. 6 where three types are shown. The smaller compound wheel is made from two $1\frac{1}{8}$ in. Flanged Wheels sandwiching a 6-hole or 8-hole Wheel Disc between them. The two larger

Fig. 7: Heavy-duty travelling gear employing wide-face centre-flange wheels. Note unorthodox use of small Helical Gears meshing with large Contrate Wheels to give a smooth and compact gear drive.



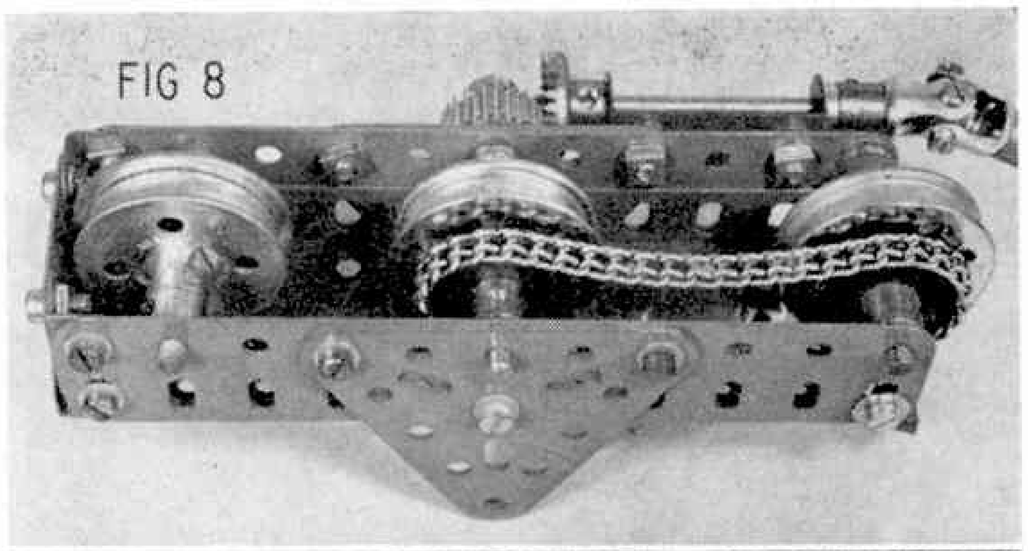
wheels are made from Wheel Flanges bolted to a Face Plate and the illustration shows how they may be constructed with shallow or wide hubs. The shallow version, in which the flanges are mounted rim outwards, gives a centre flanged wheel of minimum width, but when the flanges are mounted on the Face Plate with rim inwards, a more stable wheel is produced and a large Contrate wheel can then be bolted directly into the assembly, forming an extra boss with that of the Face Plate for additional rigidity with very little overhang from the Contrate. Being mounted integrally with the wheel, the Contrate gives an absolute positive drive. By using Bush Wheels or Wheel Discs bolted to the Wheel Flanges, additional hub support can be achieved. For the narrower of the two centre flange wheels illustrated, standard length Bolts are adequate but $\frac{3}{4}$ in. Bolts are required for the broader version where they secure the Contrate Wheel, two Wheel Flanges and the Face Plate in one go.

When applying a geared drive to travelling wheels, some thought should be given to proportionate sizes of the gears employed. In the case of the large centre-flange wheels mentioned, the Contrate Wheel shown is nicely scaled and can be driven by $\frac{1}{2}$ in. or $\frac{3}{4}$ in. Pinions. In this case, additional width of the truck carrying the wheels must be provided. An elegant solution to the problem of keeping down overall width of the wheel trucks (an important consideration in a crowded dockyard) is supplied by the use of gears which can run at right-angles to the wheel axles and over the top of them. This is achieved, as shown in Fig. 7, by the unorthodox use of the small Helical Gear which will mesh perfectly with the large Contrate Wheel at the "2 o'clock" position. Adjustment and careful packing with Washers to find the correct meshing point is essential, but once found, the drive is very smooth and quiet.

The use of the large travelling wheels outlined requires a structure of proportionate dimensions and so the use of the standard Flanged Wheels is far more popular for the smaller or medium-sized models. Fig. 8 shows a typical travelling bogey truck, suitable for a dockside crane, where linkage beetween travelling wheels is by Sprocket Chain drive, this being quite adequate. Again, Flat Girders provide adequate wall strength and the double thickness of $2\frac{1}{2}$ in. Triangular Plates provide both heavy journals for the central driven axle an strong trunnion supports for attachment of the bogey truck to the crane tower. In this case, the small Contrate drive, which gives pleasing proportions, is mounted externally on the truck.

In Fig. 9, the truck is shown mounted at the foot of one of the crane portals, and it will be noted that the triangular supports pivot in a parallel bearing. This gives alignment in the forward direction but allows the bogey some "float" to negotiate uneven levels on the dockside rails. If such a crane were required to move on a curved path of wide radius round a dock-yard basin, a universal pivot would be required to allow the bogies to "steer", i.e. be steered by the rails over which they would run. The $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip carrying the small contrate spindle provides an adequate bearing when packed out by Washers and bolted tightly to the truck wall. The Universal Couplings leading off from it may then be connected to a suitable power take-off point by appropriate shafting and gearing.

Fig. 4 shows a very neat arrangement of bogey truck for the advanced modeller, based on sound engineering principles. With four similar bogies a crane or other heavy machine would receive a twelve-



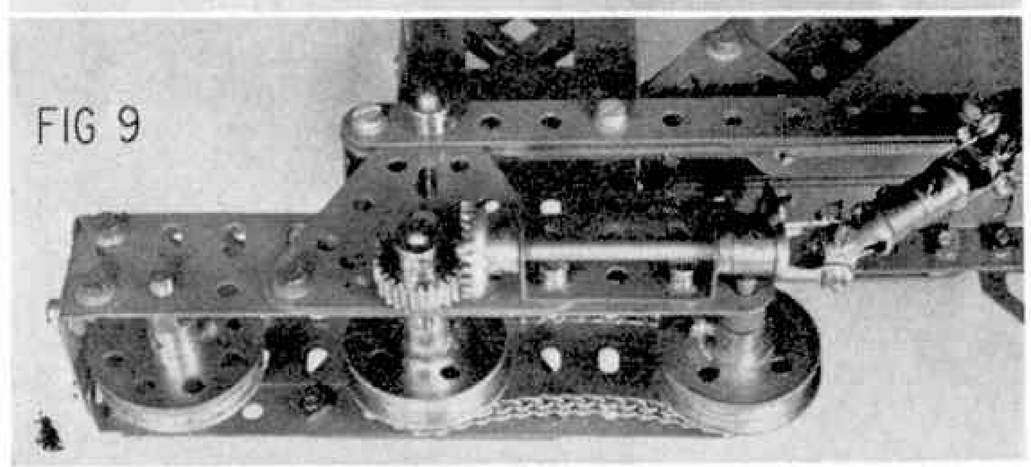
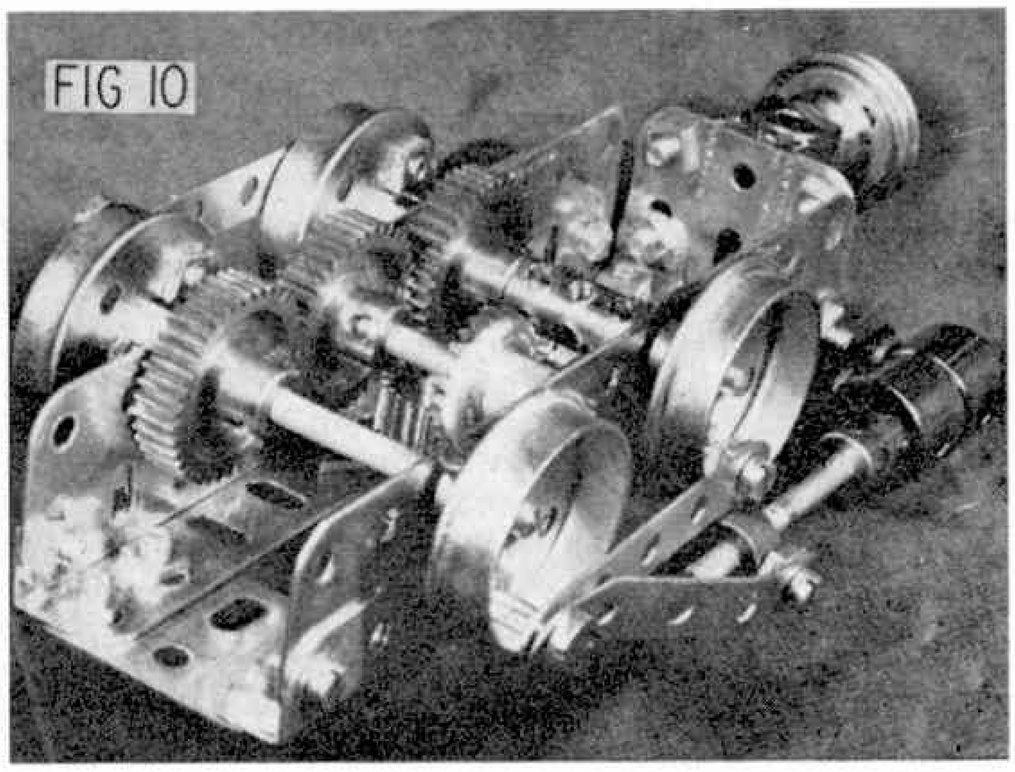




**Fig. 8: Simple powered bogey truck for dockside crane. Note strong trunnion arrangement of Triangular Plates to give adequate vertical support for pivotting arrangements.**
**Fig. 9: Drive arrangements for simple powered bogey. Universal Couplings to Contrate drive should be maintained at a shallow angle for efficient drive.**

wheel drive since every load-carrying axle is directly driven. A Worm and Pinion drive to the trailing axle in each bogey maintains the overall slimline appearance of construction without sacrificing efficient wheel drive at scale speed. Additional bearing surfaces for each axle are provided by Perforated Strips, bolted to the Flat Girders at each side of the bogey trucks, while the careful use of paired Universal Couplings enables the central vertical drive from the crane portal to be transmitted to the off-centre Worm drive shaft. A further advantage of this drive system is that the Worm shafts in each set of bogies on one side of the model rotate in the same direction, so that no split reversing gears are required from the drive shaft in the portals. It is true that, as a result, the model is "locked" when drive to the wheels is switched off, due to the "non-reverse" configuration of Meccano Worm drives, but this is of no disadvantage in the working model.

**Fig. 10: Typical use of standard Meccano Flanged Wheels in construction of powered bogey for model locomotive.**



# WORLD'S FAIR STAMPS

## by James A. Mackay

THE IDEA OF HOLDING an international fair is nothing new, as witness the great Leipzig Fairs which have been held in the spring and autumn of each year for over eight centuries, but these, as their name implied, were concerned only with the buying and selling of goods, and cultural and social aspects were quite incidental. In 1756, however, the Society of Arts in England offered prizes to manufacturers for examples of their goods and also held an exhibition of the various competitive entries. This idea was borrowed by Napoleon who organised a great trade fair in France in 1798 and another one, on an even grander scale, in 1802. This was so successful that henceforward fairs of this sort were staged at three-yearly intervals.

In 1894 plans for a Great Exhibition were laid in London and two years later the exhibition, under the chairmanship of Prince Albert, was opened at the Crystal Palace then in Hyde Park. Philatelically the Great Exhibition is remembered by the special postmark used on mail posted at the exhibition grounds. Special stationery was also provided for the use of the Commissioners for the Exhibition and examples of these envelopes are now highly prized by collectors. A special postmark was also used for the London Exhibition of 1862. The French held an international exhibition in 1867 and several commemorative labels of a private nature were produced. Postal seals for the use of the German commissioner were printed in connection with the Vienna World Exhibition in 1873.

An important philatelic landmark was provided by America's Centennial Exposition held in Philadelphia in 1876 to celebrate the centenary of the Continental Congress which drew up the Declaration of Independence. Two envelopes embossed with a special stamp in red or green, depicting a post-boy of 1776 and a mail train of 1876, were put on sale to the public. These items of postal stationery were, in fact, the world's first commemorative postage stamps.

France held its third Exposition Universelle in 1889. More than 32 million visitors flocked to see the exhibition whose principal attraction was the newly erected Eiffel Tower. Several labels were produced at the time and, of course, the famous Eiffel Tower has appeared on several stamps issued since then. In 1893 the United States marked the fourth centenary of the discovery of America by Columbus, by holding the Columbian Exposition in Chicago. This was the first occasion to be marked by an issue of adhesive stamps, a set of sixteen ranging in value from 1c to $5, being released. In addition there were stamped envelopes and postcards as well as private labels. Labels in great profusion were published for the Paris Exposition of 1900. No special stamps or stationery were released though several distinctive postmarks can be found.

The centenary of the Louisiana Purchase by the United States from France was marked in 1904 by a World's Fair at St. Louis. For this occasion a set of five stamps was issued, portraying Livingston and the former Presidents Jefferson, Monroe and McKinley. Almost thirty years elapsed before the next World's Fair was held. The First World War and the economic depression after it made such large exhibitions impracticable. In 1933, however, Chicago celebrated its centenary with the Century of Progress World's Fair. Two stamps featuring old Fort Dearborn and the new Federal Building were issued. In addition the giant airship *Graf Zeppelin* made one of its epic flights from Germany to Chicago in honour of the occasion. Germany released three airmail stamps for use on correspondence carried by the airship to the United States, while the United States issued a Zeppelin stamp to prepay postage on mail carried from Chicago back to Germany.

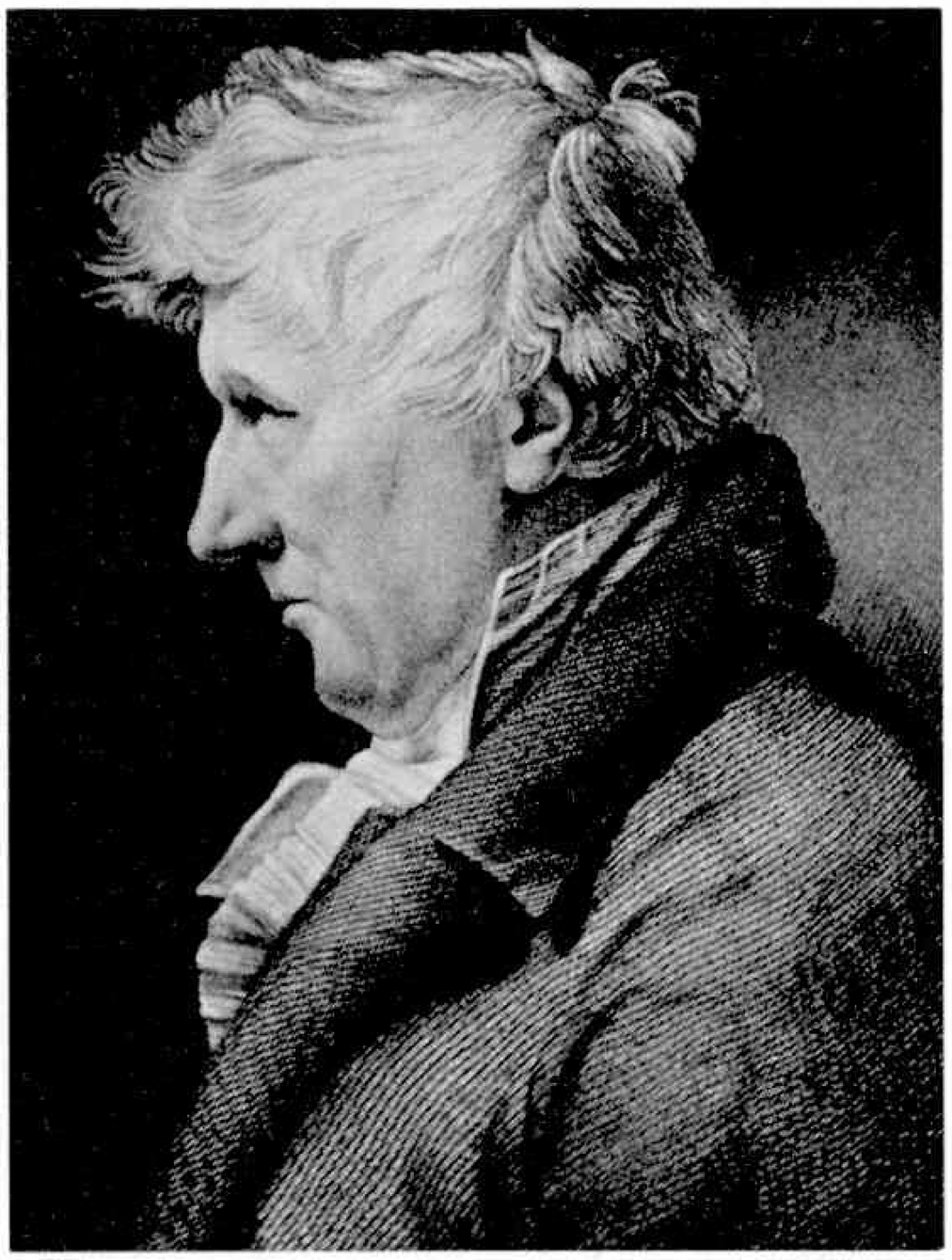
The first Brussels World Fair, in 1935, was marked by a set of four stamps. Subsequently World's Fairs were held in Paris (1937), New York (1939-40) and San Francisco (1940). The French colonies issued stamps for the Paris Fair and also for the New York Fair two years later. Many countries, from Brazil to Russia, issued stamps honouring the New York Fair. No World's Fair was held until 1958 when Brussels was again the venue. Numerous stamps were issued by the host country and many nations all over the world. This pattern was repeated for the World's Fairs held at Seattle (1962), New York (1964) and the Canadian Centennial Exposition in Montreal (1967). The frequency of World's Fairs is regulated by the International Bureau of Exhibitions, but so far no way has yet been found to regulate and control the spate of stamps released in honour of these events !

## Great Engineers No. 29

# JOHN RENNIE

## (1761 - 1821)

### by A. W. Neal



RENNIE, PROBABLY through Watt, became concerned with the building of Albion Mills, near Blackfriars Bridge London. This enterprise was regarded as one of the mechanical wonders of the day in the same way that the G.P.O. London Television Tower is today. Rennie was able to give full rein to his ingenuity and introduced many ideas foreign to the customs of the time. Although the mills were burnt down within three years, it established Rennie as an engineer.

Towards the end of the eighteenth century Rennie entered the canal construction field, and was responsible for many navigation schemes. Among these were the Bury St. Edmunds, Andover-Salisbury, and Reading-Bath canals. The preparatory and design work in itself was no mean achievement.

The first bridge that was built by Rennie was in 1784. He was twenty-three, and this was the forerunner of a whole series of similar structures. Among this series were Kelso Bridge across the Tweed, the Boston Bridge over the Witham, and the Musselburgh Bridge over the Esk. He was the architect of three great London Bridges, Waterloo Bridge (originally called Strand Bridge and now superseded) is probably the best.

Rennie acted as chief engineer during the construction of the Bell Rock Lighthouse about eleven miles from the Scottish mainland near the Firths-of-Forth and Tay. The latter was a very difficult undertaking.

Among Rennie's other large-scale works are the London and the West India Docks of the Thames, Holyhead Harbour, Plymouth Breakwater and Sheerness Dock.

Towards the close of his life there was scarcely a scheme of any public work on which he was not consulted. He was concerned, in one way or another, with projects of public water supply at Manchester, Edinburgh, Leeds and other places.

About 1812 his health began to show signs of deterioration, but he urged himself on, and even when he was confined to his house he continued with negotiations and plans.

The last work with which he was concerned was the replacement of the old London Bridge over the Thames. Rennie made an extensive investigation of the river conditions and prepared plans for a new structure, but died in his sixty-first year unfortunately before work was completed.

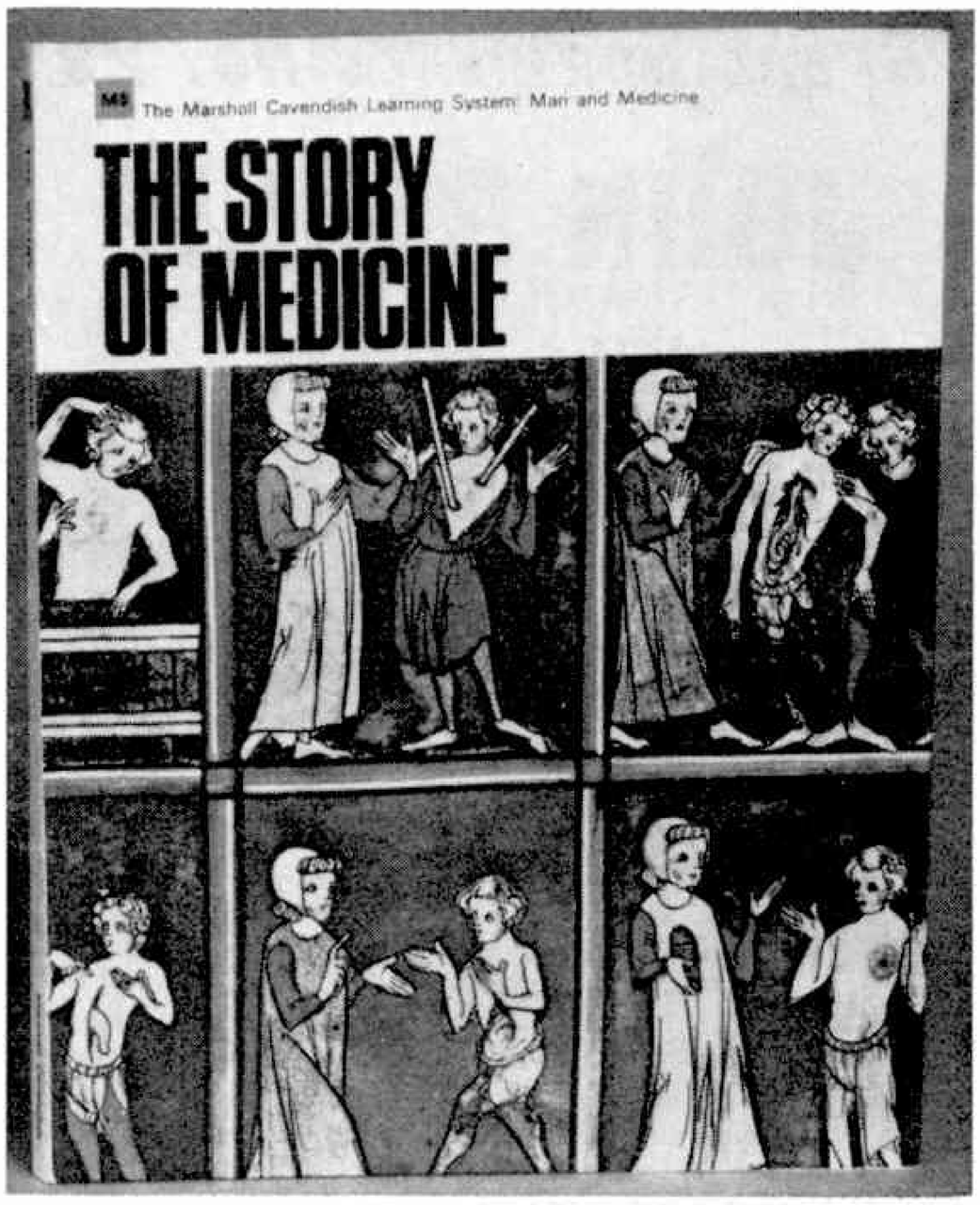
# NEW BOOKS REVIEWED

## Part I

*A series of books are now available from Marshall Cavendish, making learning easy and enjoyable to all members of the family. A vast store of knowledge is split into six key subjects each comprising twelve handy-sized hardback books well illustrated in colour and costing 9/- each. Reviews of one book from three of the series are dealt with below, the remainder will be dealt with next month. Subscribers to any one of the series can receive one free book in the first twelve, if subscribing to all 72 titles six free books are available.*

*Series One is entitled "Man and Medicine", a fascinating subject. Series 2 and 3 cover the World of Science, the vital background to today's Physics, Chemistry and Biology made clear and simple. Series 4 surveys our Cultural Heritage on a worldwide basis from Music, Literature, Theatre and Cinema to printing, sculpture and architecture. Series 5 and 6 deal in an exciting new way with History and Geography, each topic illustrated with a vivid series of colour pictures.*

*These handy books cover an immense range of human knowledge and at a few shillings a time a personal encyclopaedia may be collected. The publishers are Marshall Cavendish Books Limited and each text has been prepared under the direction of a highly qualified Editorial Advisory Board.*

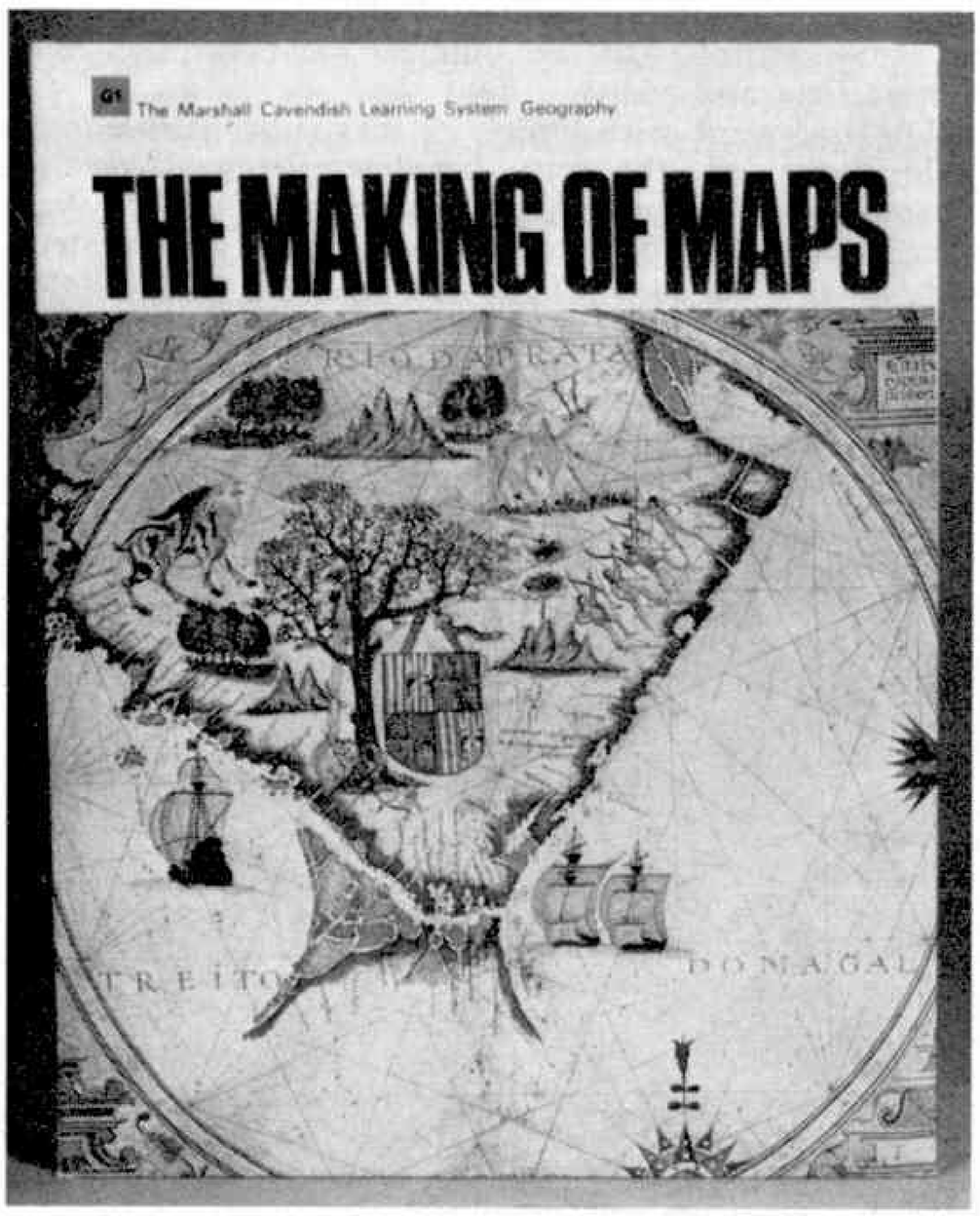



**THE STORY OF MEDICINE—The Marshall Cavendish Learning System, Series 1, Price 9/-.**

Mankind has always been plagued with complaints. The human body has always been and always will remain a source of interest and wonder. This fascinating book tells us how, in Ancient Egypt, priests performed many of the functions carried out by the general practitioner today. How Hippocrates and his colleagues treated their patients in "temples of rest", remoted and yet related to our chromium plated hospital of today. It tells how pain and sepsis have been brought under control allowing surgeons endless scope in patching up the ravages of disease today, how many hazards such as childbirth, tuberculosis and diphtheria have been practically overcome, but still mankind is plagued with complaints. This proves, we are told, that because man has a soul and a mind as well as a body, to relieve pneumonia or appendicitis is now a simple procedure, but to cure mental or emotional disease is quite another matter.

This book is filled with absorbing subjects such as the treatments prescribed by witchdoctors, the part played by the Church in days gone by, and of the crude medicaments and appalling remedies prescribed in the Middle Ages. Step by step it takes us past the milestones in medicine from the Egyptian physician to the Pharaoh in 3000 B.C. to Professor Christian Barnard who performed the first successful heart transplant.

*E. Knowles.*




**THE MAKING OF MAPS—published by the Marshall Cavendish Learning System, Series 6, Price 9/-.**

We are all familiar with maps and this absorbing book traces the history of map-making from the third millenium B.C. to the present time. It shows the progress of the earliest known maps which were of baked clay tablets to the latest correlation of ground and aerial surveys which in great detail can give us clear pictures of the world's curved surface on a flat map.

This study of historical cartography reveals how, during the last 500 years, maps have become increasingly accurate, and where the ancient map-makers were often left to guess or invent at the wide areas of space on their maps, discovery, exploration and the progress of mathematics and instrument making, coupled with modern means of travel, now enable the cartographer to achieve greater accuracy. Space travel of course now has its part to play in this. The book makes fascinating reading and is lavishly illustrated in colour ranging from a Babylonian world map over 4,000 years old to photographs taken from the Gemini spacecraft. To lovers of travel, geography and maps, this book is a " must ". *E. Knowles.*

**THE STORY OF ARCHITECTURE—The Marshall Cavendish Learning System, Series 4, Price 9/-.**

It is still a surprise to some people to learn that the building industry, measured in terms of money invested and labour employed, is the world's biggest industry. Since time began, man has built, whether a shelter or windbreak of a few boughs or skin tent, or a skyscraper of glass and steel and concrete. This splendidly illustrated book tells us how man has built igloos, bridges, pyramids, cottages, castles and cathedrals. All are set before us vividly and clearly, telling of man's need to shelter from the elements and his desire to make monuments to glorify his gods throughout the centuries. The wonderful Greek temples, the gorgeous palaces of bygone potentates, the clay and wattle huts, the huge administrative buildings of our modern world, all symbols of time and place which outlast the tiny life-span of the age that made them, are described for us in this book, which covers the whole range of architecture from before Stonehenge to the modern structures shown at Expo 67. *E. Knowles.*

**HOBBIES FOR BOYS, edited by Leslie Jackman, published by Evans. Price 18/-.**

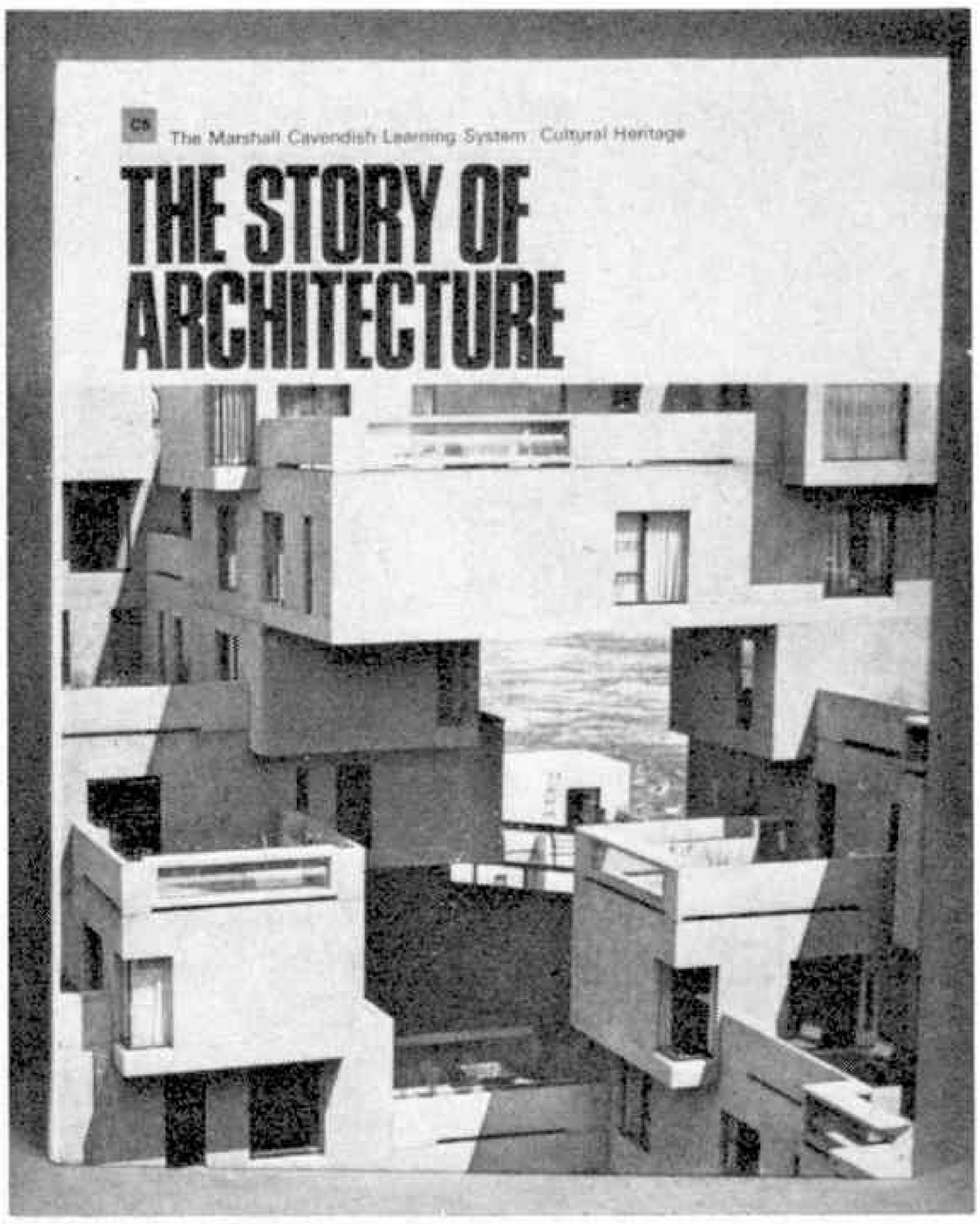
Long summer holidays are ahead, and while this prospect probably fills most of you with happy anticipation, time can start to drag after a few weeks, especially if the weather prevents outdoor activities.

A rainy day however, could provide an excellent opportunity for browsing through this book, which not only makes highly entertaining reading, but may also give you some ideas for new hobbies.

Popular pastimes such as stamps and coin collecting, modelling, photography and angling are covered, but there are also some more unusual ideas. A good project for the summer holidays could be to start your own natural history museum, and a chapter in the book shows just how easy this can be. A garden hut, part of a room, or even a few boxes can become your museum, and if you know what you are looking for, a walk in the country can produce many potential exhibits for the museum.

Birdwatching can be an adventure. This statement may sound unbelievable to someone who thinks of birdwatching as a dull hobby, but this book proves that birdwatching can be anything but that. One advantage is that you can start birdwatching in your own garden. How to build a bird table and nest box is described in detail so that instead of going out looking for birds, they will come to you. At first you may be content to stay in your garden, but once this hobby takes a hold on you it can take you to a great variety of fascinating places, even an overseas expedition !

The chapters outlining practical activities are accompanied by simple drawings, and there are numerous interesting black and white photographs. *P. Jones.*



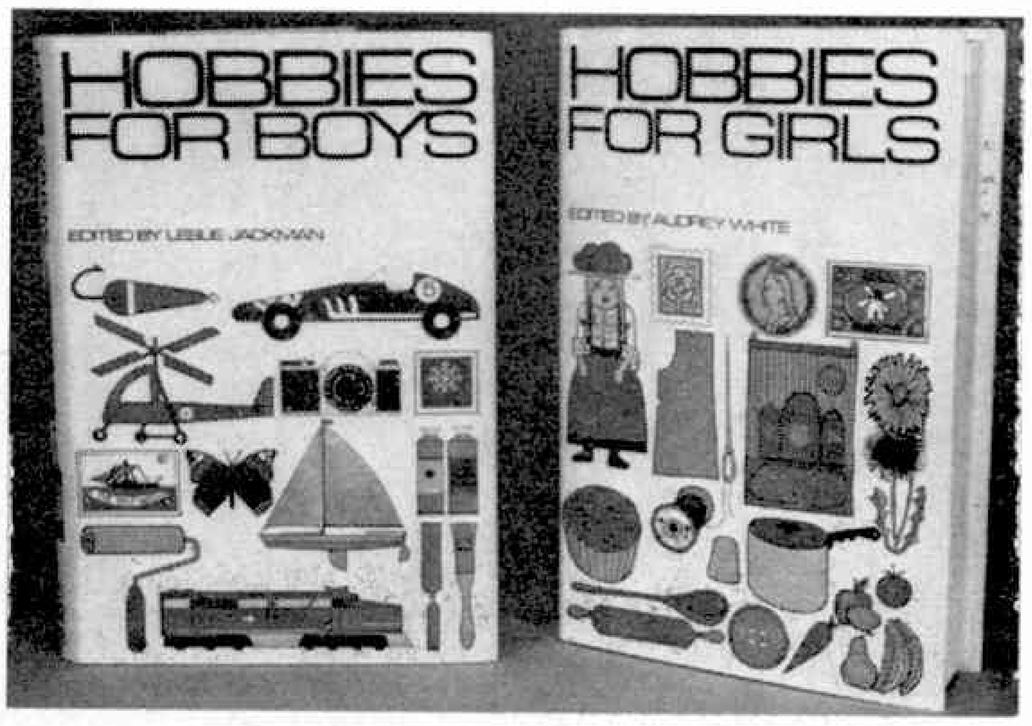

**HOBBIES FOR GIRLS, edited by Audrey White, published by Evans. Price, 9/-.**

A companion to " Hobbies for Boys " this book includes the more feminine pastimes of cooking, sewing and collecting dolls in national costume.

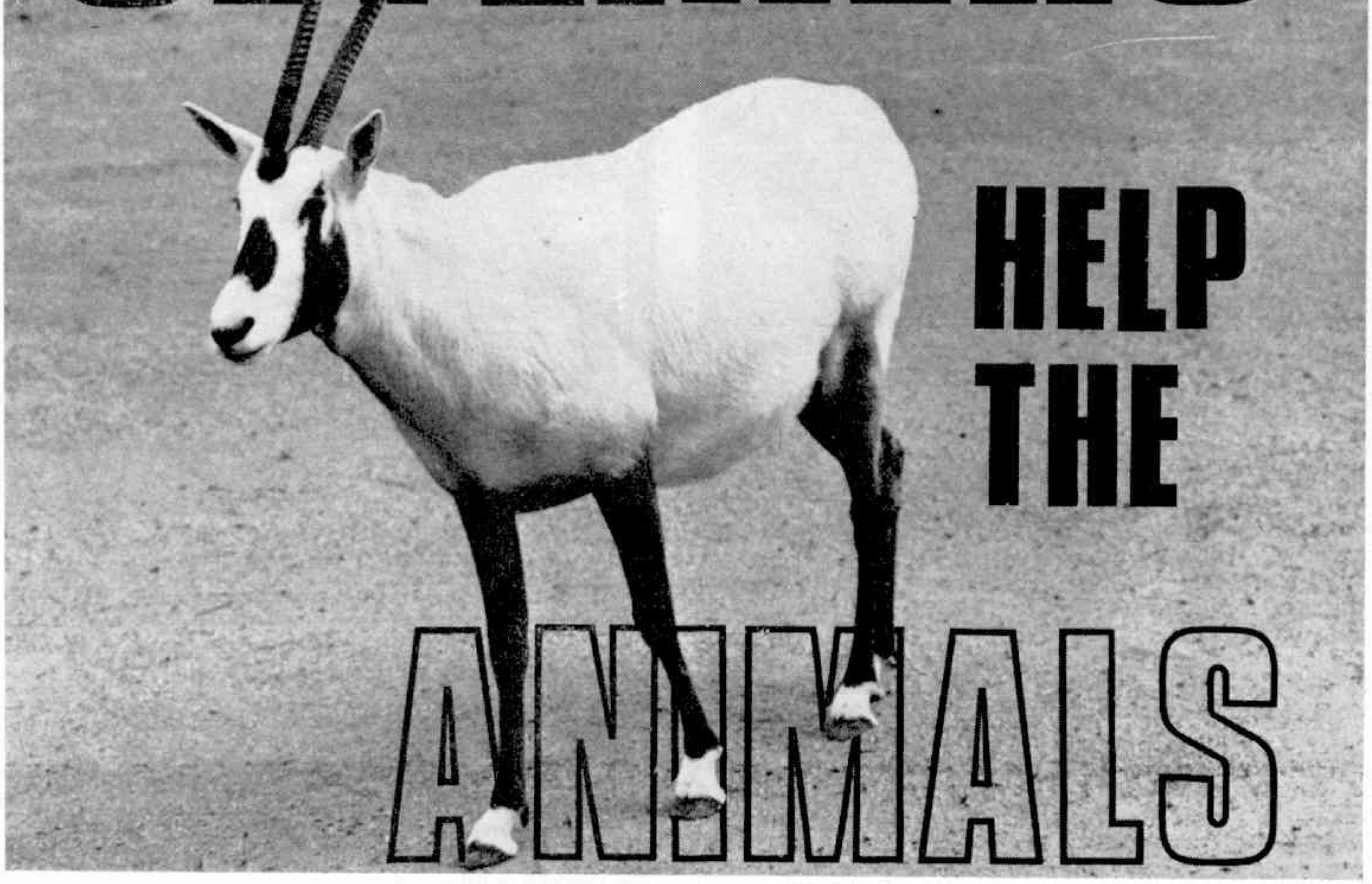
Pond hunting may not be every girl's idea of a pleasant pastime, but there is a great fascination in peering into a pool to see what creatures are there. On a warm summer day, in picturesque surroundings this can be a most enjoyable hobby, and an inexpensive one. For the more artistically inclined girls, chapters on pottery and clay modelling are included. Many people wish they could draw, and if only they tried, they probably could. The book stresses one rule, simplicity, and also gives some hints and tips on how to start what could become a lifelong hobby.

As with " Hobbies for Boys ", this book has been written by contributors who are enthusiasts, and is well illustrated by sketches and photographs. *P. Jones.*

***To be continued***



# JETLINERS HELP THE ANIMALS



## An unusual service provided by the Jet Airlines of the world, described by Michael Lorant

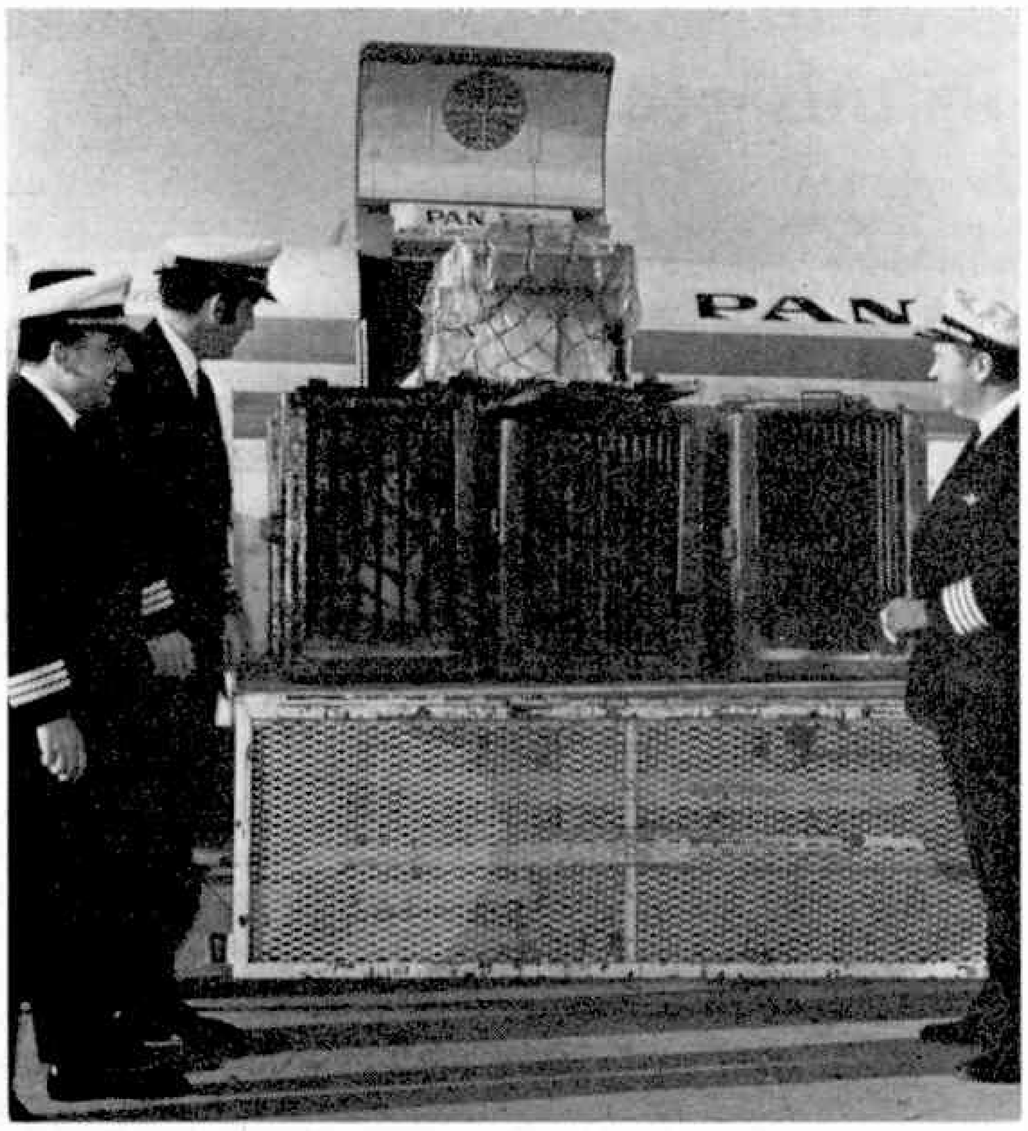
IN THE DAYS before the air cargo era, zoo animals ordinarily comprised lions and tigers and bears. It did not matter so much what species they were or from where they came. But airplanes, especially jet airplanes, have changed all that. Indirectly, *jets have also led to the preservation of many animal species which might otherwise have become extinct.* Not too many years ago the transportation of animals from zoo to zoo or from trapper to zoo was a high-risk business. Not nearly so much was known then about animal ailments. Almost any long-distance ship-board haul automatically meant a high chance for mortality for the animal cargo.

In contrast, a few months ago, two female kori bustards, South African birds related to the crane, were

**Because of aircraft, more Siberian Tigers live nowadays in zoos than in the wild.**

shipped from near Amsterdam to the Los Angeles Zoo with a guarantee of delivery in good health. The bustards were valued at 1,000 dollars (approx. £500). The shipper, Jabria animal exporters of The Netherlands, did not even bother to insure the shipment. The birds travelled by Lufthansa 707, arriving in Los Angeles the same day they left Amsterdam. The main advantage of the fast transportation is the fact that animals are no longer suffering from insufficient or improper food during transportation. In most cases, since the trips are of such short duration, the animals need not be fed at all.

This quick availability of animals to zoos all over the world has led to the preservation of some species which were threatened with extinction. The European buffalo, or " wisent " was saved by zoo breeding. Air transportation made the wisent a zoo animal; in fact, the only European buffalos in existence are in zoos. Similarly, the Iranian onager (a species of kiang or wild ass) was rare in either captivity or the wild ten years ago. Due to zoo breeding and air transportation bringing the zoos

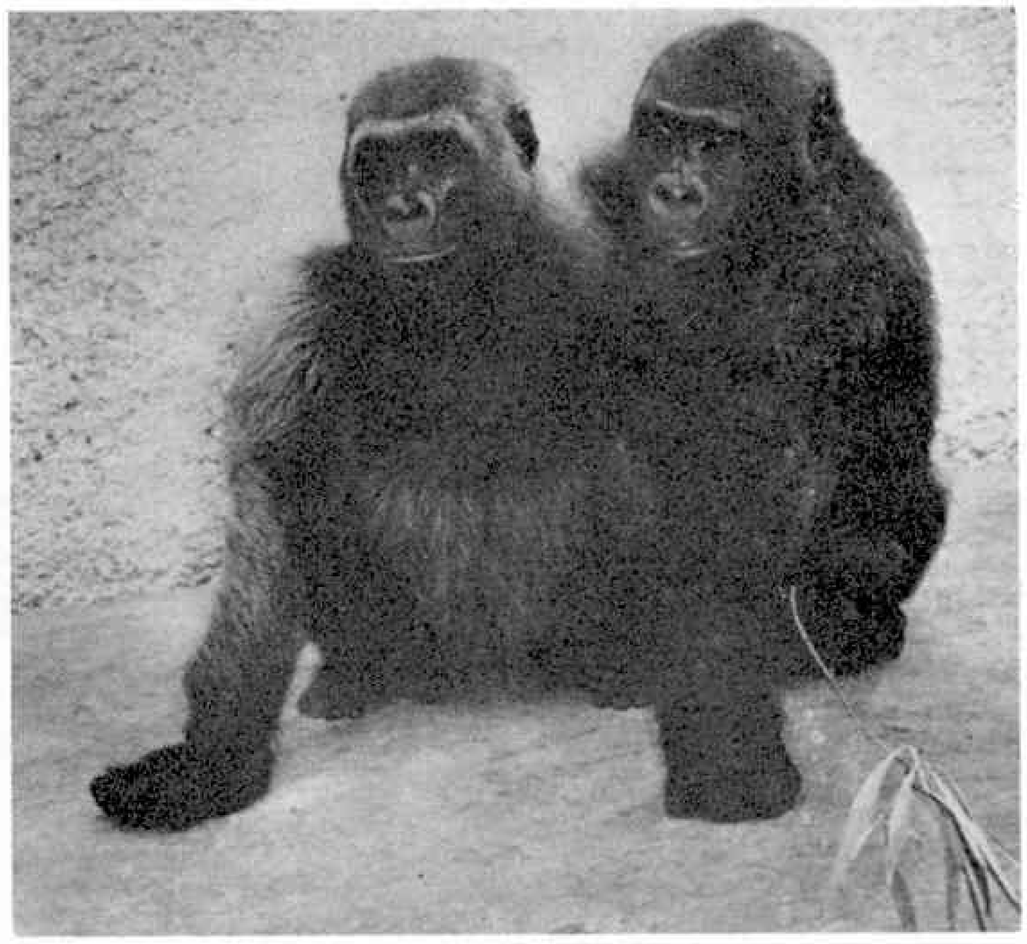



The San Diego Zoo in California got its trio of tiger cubs via Pan-Am 707 Jet Clipper.

close together, the onagers are no longer rare—at least, not rare in zoos.

N. B. Gale, doctor of veterinary medicine and assistant director of the Los Angeles Zoo, also credits air transportation with part of the advancement in animal health. Where animals may be subject to parasites in their homeland, they can now be brought quickly to a place where new medical techniques allow thorough examination and, if necessary, treatment.

Nearly all animals being transported from overseas ports to American zoos now are shipped by air. This includes young elephants as well as many species of hoofed animals from around the world. The rapid transportation has resulted in zoos obtaining animals " with little or none of the disease or malnutrition problems at one time associated with slower surface transportation."

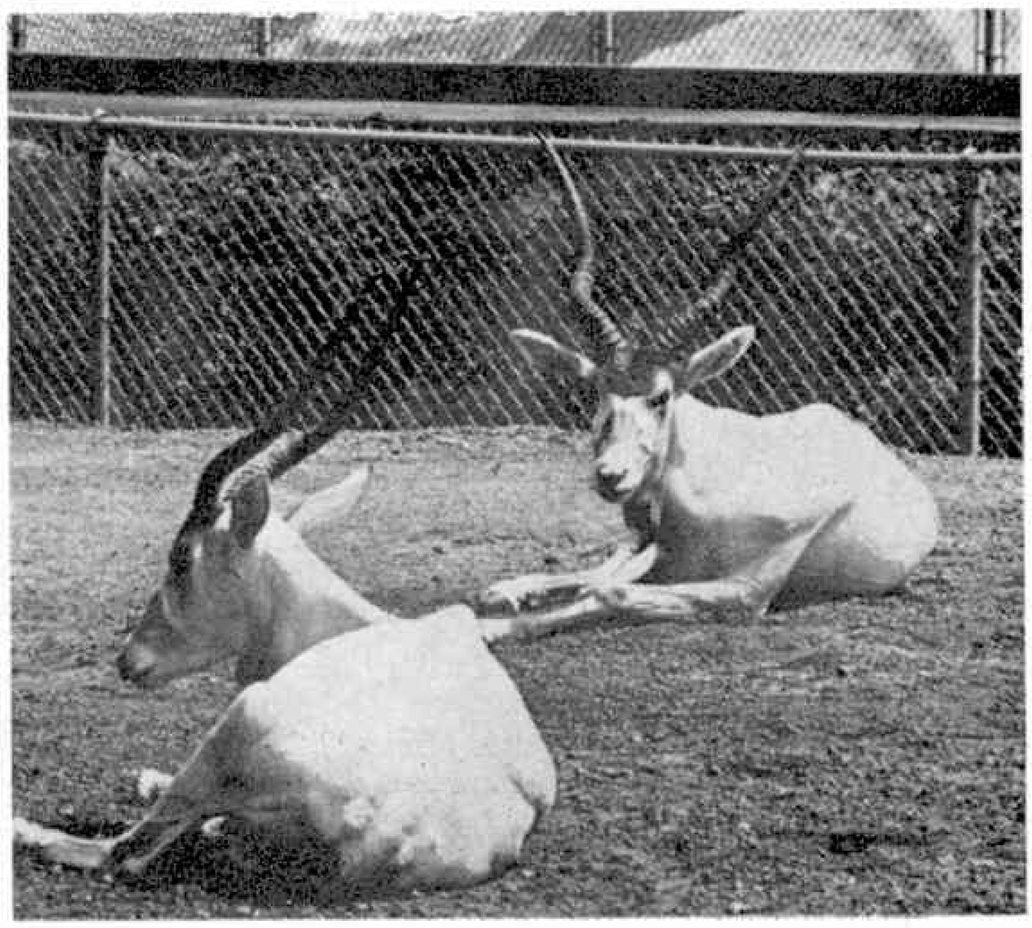


This pair of Lowland gorillas travelled by jet aircraft when they were only a few months old.

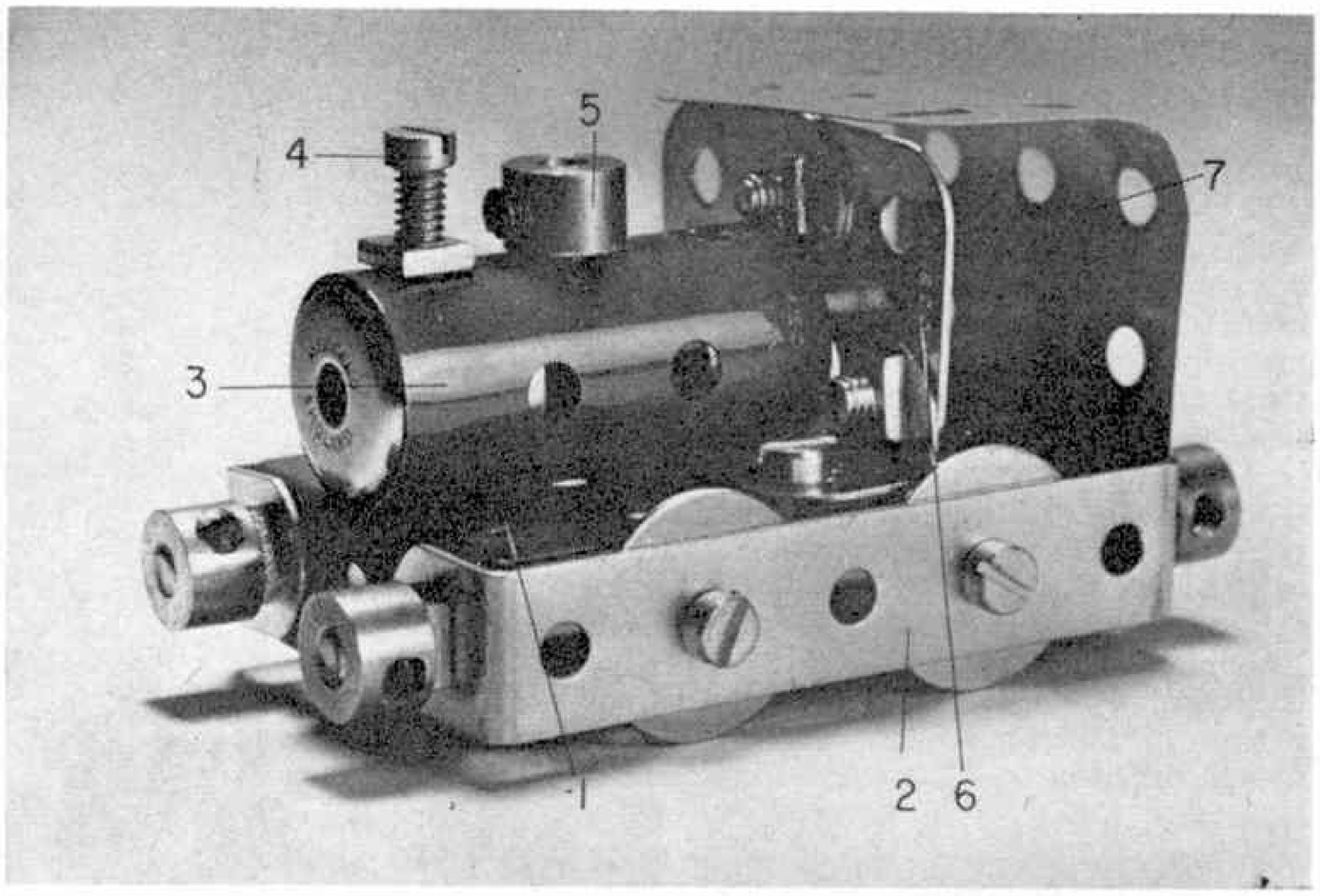
Last spring, for instance, the San Diego Zoological Gardens obtained a 12,000-dollar worth trio of Siberian tiger cubs from the zoo in Leipzig. They were all the offspring of unrelated, wild-caught parents. The Siberian tiger is the largest of all cats. These cubs weighed about 150 pounds each on arrival in San Diego. When full grown, they will weigh more than 500 pounds each. They are the first Siberian tigers for the San Diego Zoo. However, there are about 160 in other zoos around the world. It can authoritatively estimated that there may be 150 Siberian tigers left in the wilds of upper Asia.

All cloven-hoof mammals, such as giraffes and antelope, cannot be flown directly to the delivery point in America from an overseas location due to U.S. quarantine regulations. After a 30-day stay in Clifton, New Jersey, such animals are released and then air-shipped to zoos.

A couple of specimens of ADDAZ, African antelope, have been transported to the States via jet liner.



***There is a certain appeal about simple models that manage to 'put-over' the appearance of the full sized subjects that they represent. "Spanner" describes three such models in this feature entitled . . .***



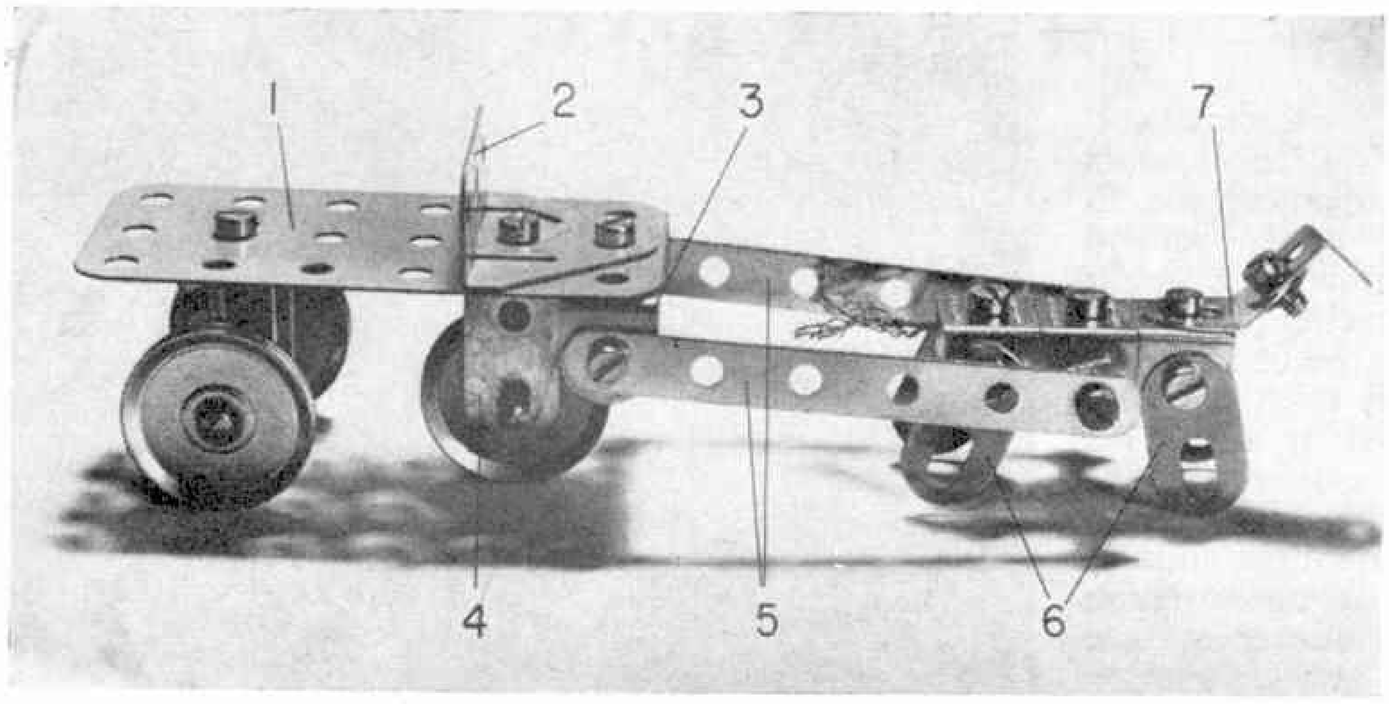

# TRANSPORT SIMPLICITY

ONE OF THE ADVANTAGES of preparing the Meccano model-building section of *Meccano Magazine* is that I can feature the models I want to feature. There's nobody to argue with me!

This does not, of course, mean that I include only the models that appeal to my own particular tastes—I certainly do not—but it does mean that, when I come across a model I do personally like, I can feature it without any recriminations. And this is precisely what I do here! Described below are three "simplicity" models—an 0-4-0 Tank Locomootive, a Tugboat and a Horse and Cart. I feature them mainly because I like simplicity models, myself, but also because I know that most other people like such models equally as much as I do. They were designed by a 14-year-old reader, Roger Jones of Southport, Lancs. and I think readers of all ages will join with me in congratulating him.

## Locomotive

You might say that an added attraction simplicity models hold for me lies in the fact that they need very little describing! The Loco, for example, consists of a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 1, between the flanges of which two $2\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strips 2 are bolted, the shanks of the securing Bolts pointing outwards. A collar is fixed on the protruding shank of each of these Bolts to serve as a buffer, while the wheels (non-revolving) are simply represented by four $\frac{3}{4}$ in. Washers bolted two to each Double Angle Strip 2.




**Above: A delightful little Tank Locomotive, one of three "simplicity" models designed by 14-year-old Roger Jones of Southport, Lancs.**

**Left: The cart might be a bit too big for the horse, but this Horse and Cart model is still full of appeal.**

The boiler is nothing more than a Sleeve Piece 3 bolted to Flanged Plate 1 and fitted with a Chimney Adaptor in its forward end. A $1\frac{1}{8}$ in. Bolt 4, held by Nuts in the Sleeve Piece serves as the chimney, while the valve dome is a Collar 5 on an ordinary Bolt held in the Sleeve Piece. Two 1 in. Corner Brackets 6, attached by Angle Brackets to Plate 1 complete the cab front, whereas the roof and back of the cab are enclosed by a shaped $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flexible Plate 7, this Plate being held in place by the two Bolts fixing the appropriate ends of Double Angle Strips 2 to the Flanged Plate. That's all there is to it.

**PARTS REQUIRED**

| | | | |
|---|---|---|---|
| 2—12 | 4—38d | 5—59 | 2—133a |
| 16—37a | 2—48a | 4—111c | 1—163 |
| 10—37b | 1—51 | 1—111d | 1—164 |
| 2—38 | | | 1—188 |

## Tugboat

Slightly more complicated than the Loco, but still well within the "simplicity" category is the Tugboat. A Trunnion 1 is bolted to one flange of a $2\frac{1}{2} \times 1\frac{1}{2}$ in. Flanged Plate 2, a $1\frac{1}{2} \times 1\frac{1}{2}$ in. Flat Plate 3 and a second Trunnion 4 being bolted to the other flange of the same plate. Two shaped $5\frac{1}{2}$ in. Strips 5 are attached by Angle Brackets to the sides of the Plate, as shown, then the ends of the Strips are connected together, also by Angle Brackets.

Bolted to the top of Plate 1 are two Girder Brackets 6, the long flanges overlapped one hole and the short flanges pointing upwards at the edges of the Plate. Two Trunnions, joined through their apex holes, are fixed one to each short flange, the Trunnions themselves being overlayed by a Flat Trunnion 7, its apex pointing towards the stern of the Boat. The mast is supplied by a $2\frac{1}{2}$ in. Rod held in a Collar fixed by a Bolt to Flat Plate 3, the lower end of the Rod passing through a hole in Trunnion 4. The crosstrees are $\frac{1}{2}$ in. Bolts 8 screwed into the threaded bores of a Collar fixed on the mast.

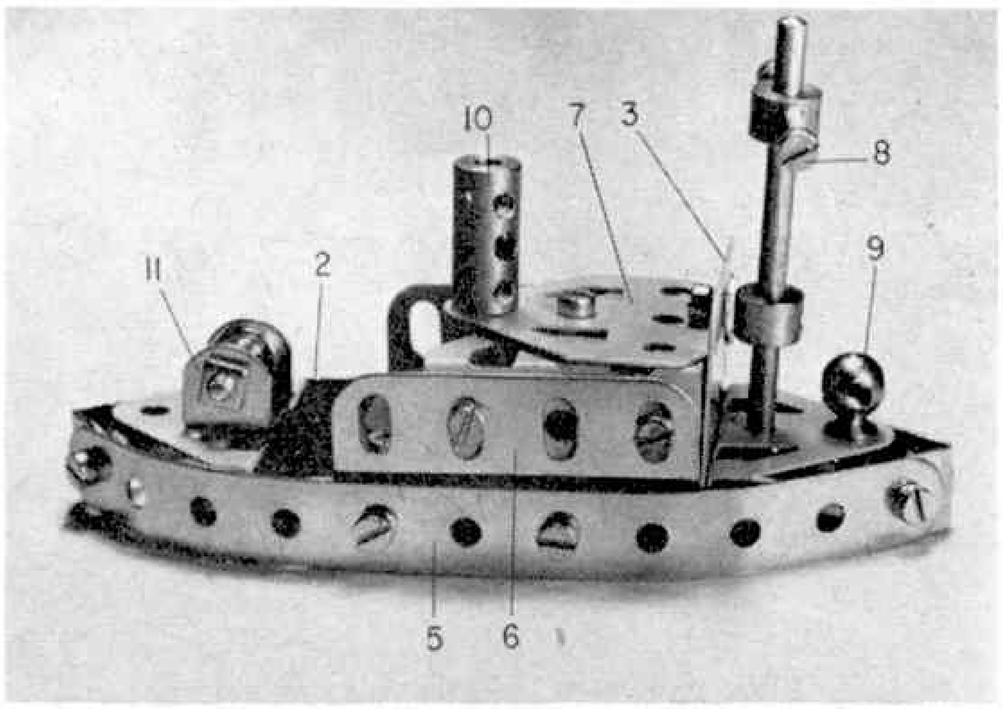
Finishing touches are supplied by an imitation winch at the stern, a central funnel and a large bollard in the bows. The last is supplied by a Handrail Support 9 fixed in the apex hole of Trunnion 4 while the funnel is a Coupling 10 secured on a Bolt in the apex hole of Flat Trunnion 7. The winch, however, is built up from a Double Bracket 11 bolted to Trunnion 1. Fixed in the lugs of the Double Bracket is a $\frac{3}{4}$ in. Bolt on which a Compression Spring is mounted, each end of the Spring being spaced from its respective Double Bracket lug by two Washers.

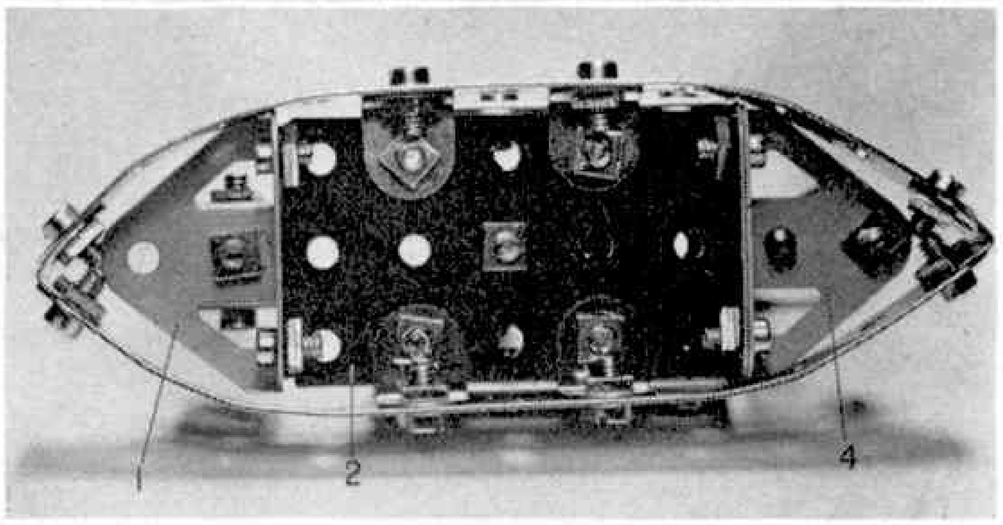
**PARTS REQUIRED**

| | | | |
|---|---|---|---|
| 2—2 | 23—37b | 1—63 | 1—120b |
| 1—11 | 6—38 | 1—74 | 4—126 |
| 6—12 | 1—51 | 1—111 | 1—126a |
| 1—16a | 2—59 | 2—111a | 1—136 |
| 25—37a | | | 2—161 |

## Horse and Cart

In the case of the Horse and Cart, a slight anomaly arises over the fact that the Horse is abnormally small in relation to the Cart! Strangely enough, though, this does not detract from the appeal of the model, bearing in mind that it is only a representation. The Cart consists of a $3 \times 1\frac{1}{2}$ in. Flat Plate 1, to the top




**Upper : The Tugboat, uses very few parts, yet manages to capture an authentic air.**

**Lower : An underside view of the Tugboat showing the Angle Brackets fixing the $5\frac{1}{2}$ in. Strips to the Flanged Plate.**

of which a Trunnion 2 is bolted for a seat, the securing Bolts fixing a $1\frac{1}{2} \times \frac{1}{2}$ in. Double Angle Strip 3 and a $1 \times \frac{1}{2}$ in. Double Bracket 4 to the underside of the Plate. Mounted between the lugs of the Double Bracket, on a 1 in. Rod, is a 1 in. Pulley with boss serving as the front wheel, the rear wheels also being supplied by 1 in. Pulleys with boss, mounted on a $1\frac{1}{2}$ in. Rod journalled in the lugs of a second $1 \times \frac{1}{2}$ in. Double Bracket bolted to the underside of the Plate. Two 3 in. Narrow Strips 5 lock-nutted to the lugs of Double Angle Strip 3 serve as the Cart shafts.

Equally simple in construction is the Horse. Three Double Brackets are bolted to a $1\frac{1}{2}$ in. Strip to represent the body, the legs being supplied by four Fishplates 6 bolted two to the lugs of the first Bracket and two to the lugs of the last Bracket, as shown. In addition, an Obtuse Angle Bracket 7 is bolted to the top of the first Double Bracket to act as the neck, the actual head being represented by an ordinary Angle Bracket fixed to the free lug of the Obtuse Bracket. The tail is simply a short length of Cord trapped between the rear Double Bracket and the $1\frac{1}{2}$ in. Strip. When completed, the Horse is "harnessed" to the shafts of the Cart by Nuts on $\frac{1}{2}$ in. Bolts fixed in Narrow Strips 5.

**PARTS REQUIRED**

| | | | |
|---|---|---|---|
| 1—6a | 1—12c | 21—37a | 2—111a |
| 4—10 | 1—18a | 11—37b | 2—111c |
| 3—11 | 1—18b | 1—48 | 1—126 |
| 2—11a | 3—22 | 1—73 | 2—235a |
| 1—12 | | | Small piece of Cord. |

# LONDON MARKETS

## by Edyth Harper

## Photographed by Robert Bristow

A GENERATION AGO, searching for antiques was considered an unusual hobby, carried on by a few people with specialised knowledge. Today, thanks, in some degree, to radio and television programmes, nearly everyone is on the lookout for a bargain.

The happiest hunting-grounds for antiques and off-beat objects are London's street markets. In years gone by, really valuable things were sometimes found for a song on market-stalls. Today traders are as knowledgeable as the public but there is always the chance that they may have overlooked something of value and that chance lures the bargain-hunters.

Petticoat Lane and Portobello road are among the well-known street-markets in London. All told, there are over 100 and each has its speciality. Club Row on a Sunday morning has pets for sale. Gardeners head for Columbia Road on the Sabbath. Farringdon Road is the place for a book-bargain. Camden Passage rivals ' The Lane ' in variety while Shepherd Street, Lambeth Walk, Leather Lane and The Cut, Waterloo Road all attract customers.

Petticoat Lane opens from 9 a.m. to 2 p.m. on Sundays and provides almost anything anyone wants to buy. In 1623 it was Pettycote Lane, but spelling was a matter of choice in those days. In 1610 it was spelt as we know it, but in 1830 it became (officially) Middlesex Street. In its earlier days, old and second-hand clothing was the produce. Today the choice is wide, from food to furbelows. Stall-holders' rights are protected by the Stepney St. Traders' Association. To set up a stall costs about £30 a year and stall-holders have certain

regulations to observe. They can only sell what their licence prescribes with the exception of second-hand furniture and clothes.

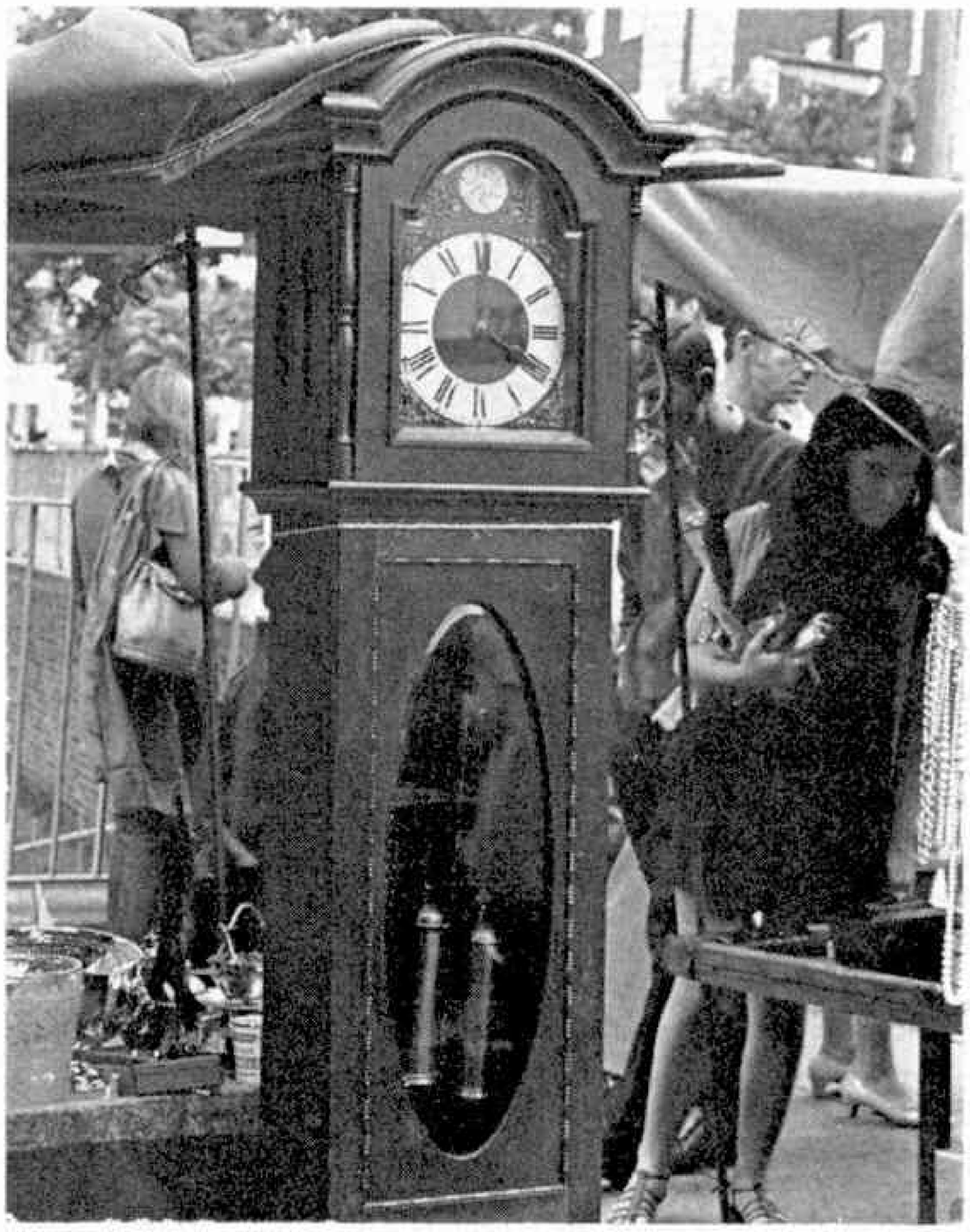
Portobello Rd. Market is of more recent origin. It started on Saturdays in the 1860's. Since 1928, the London Council has been in control, issuing temporary licences, or general ones. Food must not be sold near old clothes. Garden produce must be sold separately from pot-plants and inspectors keep a close eye on hygiene. Roughly, goods for sale are grouped in three categories, antiques, food, and second-hand goods, such as bedding, clothing, materials, etc.

Fashions in junk and antiques change rapidly. Today's hunt for 1930 clothing and stuffed owls will have changed next year to, say, utility furniture and war-time radios. Old gold picture-frames are generally sold, though the oilpainting they hold may be worthless.

It is as interesting to watch the buyers as it is to hunt for bargains. Why did that youngish men seem eager to part with 30s. for a set of croquet-balls ? The woman examining a Victorian vase could possibly own an antique shop in Cumberland. Every race and colour haunt London's street markets. A turban Indian gentleman may secretly smile at ' Benares ' brass which he knows hails from Birmingham, but he may be delighted to acquire a ' Present from Yarmouth ' plate.

Money changes hands rapidly in markets. It is wise to guard yours carefully for a crowd pushing round stalls is ideal for a deft pick-pocket. The fun of bargain-hunting loses its appeal if you find your pockets empty when you leave.

Whether you want to cut a dash in a deer-stalker, acquire a china dog, or some old silver, the stalls in Portobello Road should offer you a good choice. The trouble is, though you may set out in search of a china



dog, you are just as likely to come home with a beaded shawl or shell-trimmed trinket box. The strongest mind seems to falter in market atmosphere. You have to be very firm of purpose to buy only what you want, when confronted with such bewildering choice. That's why street-markets still prosper after centuries of service.

# AIR NEWS

*by John W. R. Taylor*

## America's quiet Aeroplanes

ONE OF THE BIGGEST PROBLEMS in any war against guerilla forces is to find and keep track of the enemy. In Vietnam, the Americans have discovered on countless occasions that concentrations of Viet Cong, and North Vietnamese troops, have heard the engines of an approaching U.S. reconnaissance aircraft and managed to hide themselves long before the aircrew could spot them. Alternatively, the warning has come early enough to enable the enemy to lie in wait for the reconnaissance 'plane and shoot it down as it came within range.

It was for this reason that the U.S. Army became interested in the idea of putting into service a completely new kind of quiet reconnaissance aircraft.

Lockheed Missiles and Space Company was first to prove the feasibility of the concept. At its own expense, it built a little aeroplane known as the Q-Star, which is said to have made observation flights at a height of 100 feet over Vietnam during the 1968 Tet offensive, without being detected.

As a result of the Q-Star's success, the U.S. Army awarded Lockheed a $2 million contract in July 1968, to develop a completely new quiet reconnaissance aircraft designated YO-3A.

To save time and money, the company used the existing all-metal airframe of the Schweizer SGS 2-32 two/three-seat sailplane as the basis for the YO-3A. They lowered and strengthened the 57-ft.-span wings, and extended the wing-roots forward to house the main landing wheels when retracted. These wheels replace the original single centrally-mounted wheel of the sailplane, and a larger tailwheel is also fitted.

The tail unit is little changed, but the fuselage is modified extensively. Pilot and observer sit further aft, under a huge transparent canopy, with the pilot in the rear position. This makes room in the nose for a heavily-muffled Continental six-cylinder piston-engine, driving a six-bladed wooden propeller.

An even neater version of the same idea has now come from LTV Electrosystems Inc. of Dallas, Texas. First flown in February of this year, LTVE's Model L450F single-seater is also based on the airframe of an SGS 2-32 sailplane, but retains the original mid-wing layout. It is powered by a Canadian-built Pratt & Whitney PT6A-29 turboprop engine, derated to 680 s.h.p., and has a fixed tricycle undercarriage, with spring steel main legs of the type fitted to the Schweizer-built Grumman Ag-Cat agricultural biplane.

**Designated the YO-3A, the aircraft has been adapted from the Schweizer SGS 2-32 glider. Because the glider had a large wingspan of 57 ft. it is possible to keep it aloft on long flights with the aid of relatively little engine power. So Lockheed added a six-cylinder piston engine with a six-bladed propeller. The result a 30 ft. long two-seater aircraft which is inherently quiet.**

All kinds of small refinements have been made to the airframe, which was modified by Schweizer to LTVE drawings. The wings and fuselage have been strengthened and covered with heavier metal skin. The area of the fin and rudder has been increased, and speed-brakes added above and below the wings.

The strengthening enables the LTVE L450F to carry a heavy load of electronic equipment and 1,900 lb. of fuel—sufficient for it to remain airborne for 24 to 30 hours while it cruises at 105 m.p.h. at 45,000 feet.

What makes the LTVE machine of particular interest is its versatility. The company has designed an alternative version, with a piston-engine, which would offer a longer endurance at low altitude. And either version can be fitted with an autopilot and automatic stabilisation equipment for operation in pilotless form, with the canopy removed and the cockpit faired over. It could be controlled remotely from the ground over a radius of 250 miles.

As well as its obvious usefulness for military reconnaissance, such a machine could be sent up in undeveloped parts of the world, to fly slowly in circles at a height of more than eight miles carrying electronic relay equipment of the sort fitted in communications satellites. This would enable it to relay military or civilian telephone, radio and TV transmissions over a wide area, at a fuel cost of only ten shillings an hour.

## Skyvan to the Rescue

While Shorts' Skyvan demonstrator, G-AWSG, was in Nepal recently, it was able to show its paces in an unusual kind of rescue mission.

The King of Nepal's personal aircraft, a Twin Otter, had been damaged while operating into the small Himalayan airstrip of Jomoson. This strip is only 1,200 ft. long, at a height of 8,000 ft. and with a gradient of one-in-ten; but this presented few worries to the crew of the Skyvan, who had been flying into many similar strips, up to 10,000 ft. above sea level, surrounded by the towering peaks of the Everest massif.

Only one journey was necessary to fly in everything required to get the Twin Otter airworthy again. The Skyvan's load consisted of a replacement engine and propeller, a new nose-wheel unit, a complete fuselage nose section, three mechanics, tools and jigs.

**A Skyvan, flying in equipment for repairing the King of Nepal's Twin Otter (foreground).**

## Aircraft help Farmers

Everyone knows that the Russian national airline, Aeroflot, is the biggest in the world. Last year, it

carried 68 million passengers; but this represents only one of the many facets of its work.

Aeroflot is responsible for virtually all civil air transport operations in the Soviet Union and, among other things, its agricultural aeroplanes and helicopters will spray chemicals over an area of 200 million acres this year. This not only sounds a vast area—it is!—more than six times the total area of England !

In addition to spreading chemical dust and spray to promote growth of crops and destroy weeds and insect pests, the aircraft will apply mineral fertilisers to make barren soil productive, and defoliate cotton plants to make the picking easier.

Twin-engined Kamov Ka-26 helicopters, which can lift a ton of chemicals, are being used on a large scale for the first time this year.

The work began early in the southern Republic of Kazakhstan, where aircraft were used to spread coal dust over the snow-covered fields, to trap the warmth of the spring sun and so accelerate thawing. Air sowing of rice is also being carried out for the first time in Kazakhstan this year.

**A V.C.10, flying testbed for the Rolls-Royce R.B.211 engine fitted in TriStar " pod ".**

## Can Lasers beat the Boom ?

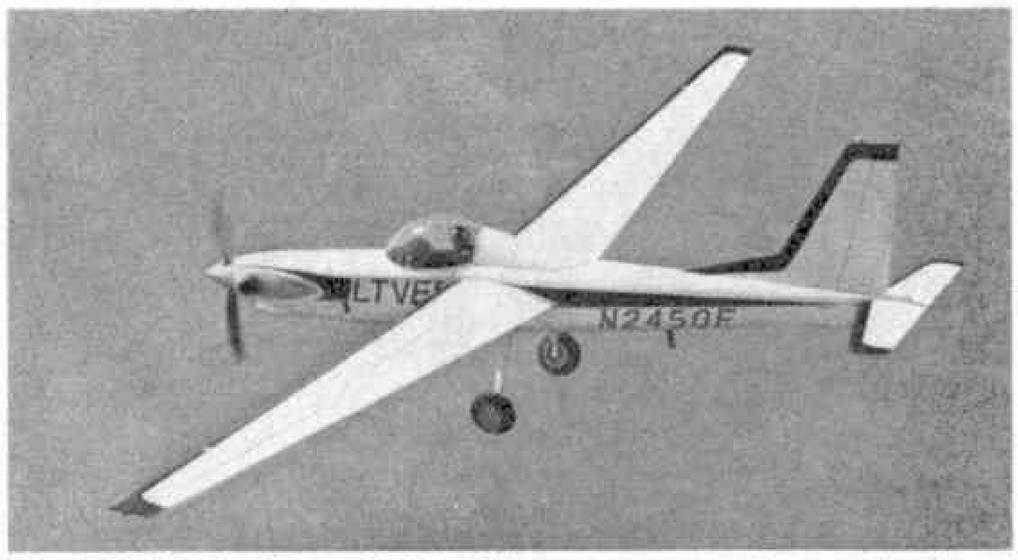
Unless ways can be found to defeat the sonic boom created when supersonic airliners fly faster than sound, aircraft like the Concorde may be forbidden to exceed Mach 1 over land. As a result, designers and research centres all over the world are trying to find ways of " quietening " the boom.

America's Federal Aviation Administration has awarded a $70,692 contract to General Applied Science Laboratories of Westbury, New York, for a year-long study of the problem. They will concentrate on altering the pattern of airflow around an aircraft in supersonic flight, by the use of unconventional airframe shapes as well as by laser beams and electromagnetic techniques. By " bending upward " the cone of shock-waves that causes the boom, they might lessen greatly the noise heard on the ground. The results of the research will be published in the form of a report in mid-1971.

## Tri-jet VC10

How many engines has a VC10 ? Normally, of course, the answer is four Rolls-Royce Conway turbofans, mounted in pairs on each side of the rear fuselage; but G-AXLR is unique, as it is now flying with only three engines.

The reason is that 'XLR has been converted into a flying test-bed for the very advanced Rolls-Royce RB.211 three-shaft turbofan engine which will eventually power the Lockheed TriStar airbus. An RB.211 gives about twice the thrust of a Conway; so it was



**IN FLIGHT—The LTV Electrosystems, Inc., developed L45OF aircraft has completed its first series of flight tests. Shown here at 7,000 feet over Greenville, Texas, L45OF is manned for testing or ferrying. As a drone, the aircraft is a complete electronic data relay system with a sustained loiter capability above 45,000 feet for more than 24 hours.**

quite feasible to remove one pair of engines and replace them with a single RB.211 in the kind of pod that will be used on the TriStar.

The VC10 flew for the first time in its new form on March 6th. Its two initial test flights with the RB.211 engine totalled more than two hours, during which it reached 460 m.p.h. at 15,000 ft. More than 1,100 flying hours are scheduled for the RB.211 before it enters passenger service in the TriStar. The VC10 was chosen as the test-bed because its performance matches closely that planned for the Lockheed airbus.

## The Spritely Transall

One of the most surprising photographs I have received this year is that reproduced below showing a Transall C 160 transport of the *Luftwaffe*. Although the aircraft's cabin was probably empty at the time, it is rare that such large machines perform steep fighter-like turns of this kind at low altitude.

Built under joint Franco-German partnership, by Nord-Aviation, Hamburger Flugzeugbau and VFW, the C 160 has a span of 131 ft. 3 in., length of 106 ft. 3½ in., and loaded weight of over 48 tons. Powered by two 6,100 e.s.h.p. Rolls-Royce Tyne turboprop engines, built under licence, it can carry nearly 16 tons of payload at 300 m.p.h. Orders include 110 for the *Luftwaffe*, 50 for the French Air Force and nine for the South African Air Force.

**The Transall C.160 transport aircraft.**

# BATTLE

## by Charles Grant

### PART XXVI

## *The 'Morale' rule in operation*

A view of a combined advance of tanks and infantry.

IT SHOULD NOT take too long to describe just how the Morale Rule works—a few words, and one or two individual examples of situations in which it will have to be evoked should suffice.

As has already been stated, experience has shown that every unit finding itself susceptible to a morale rating starts with a total of 10, and this will vary by reason (a) of a dice throw which adds the imponderable or unpredictable, and (b) of the various factors concerning protection, number of casualties already suffered, etc., which have already been discussed. Right then, as soon as the situation has arrived when a morale rating has to be ascertained—that is, when casualties have been suffered, or the transport of the section we are considering has just been destroyed—then a throw of a die (this sounds a trifle pedantic, but is really the correct singular of the plural 'dice') has to be made, and the result added to the 10 with which the unit commenced. Indeed the 10 is the constant, altered only by subsequent factors. These are quickly totalled and subtracted from —or in one case, added to—the sum of the original 10 and the dice throw. If the final result be 10 *or more*, then the morale of the group being considered is O.K., and it can carry on with whatever orders it may have been given. If, on the other hand, the final Morale Reaction Total is less than 10, then the circumstances change dramatically, and for some time, at least, the section will be out of control of the 'general' or, if you like, the player. What happens then remains to be seen, but first let us take a look at a couple of examples to illustrate our system.

Let us consider a section of infantry advancing—on foot in this case—towards some objective when it comes under enemy artillery fire, the section, that is. Let us assume that the men composing the section are proceeding along a road with open fields on either side, and cover is therefore conspicuous by its absence. On the particular move during which the enemy brought fire to bear (no casualties had been suffered previously) an officer and one man were hit, and had to be removed from the table. This would be quite a blow and, following our rule, before the remainder of the section can continue its advance, the Morale Rating has to be tested. With the 10 in hand, as it were, a die (ordinary type, numbering 1 to 6) is rolled, and it turns up no less than a 6, giving, obviously, an initial total of 16 (a very satisfying result for this particular wargamer). But now for the deductions, of which the first, we remember, is *Control*. This at once gives the first 'minus'. The officer was a casualty, so 1 is deducted. *Cover* is the next consideration, and again our people are in trouble —on a road, fields on either side. Consequently, as they have to be rated as being in the open, another 1 has to be subtracted—so far, two down. The third, *Communication*, follows, and here I assume that the section is one in my own setup—no radio, in fact. They are also some considerable distance away from the H.Q. Company, and so must be deemed as being 'out of touch'. Yet

another ' 1 ' to be deducted, making a total of 3 altogether. Rank and file *Losses* have to be considered next. There was only one, we recall, and as that does not make up the quarter of the establishment, no deduction on this count is necessary (had *two* been lost, that would have been a different story). Finally, the penalty for loss of transport does not apply, the section having already ' debussed ' before beginning its advance. Summing up then, the deduction to be made is not too bad, in fact being 3, and, taking this from the 16 already recorded, the final and satisfying total is 13, well in excess of the required 10, and the unit is still in good spirits. Of course, as has already been laid down, this particular section would have to stand fast for two moves until the second-in-command took over. Remember the business about officer casualties ?

So much for the first example: now for the second. Again using the infrantry section as a species of military ' guineapig ', we assume it to be in a half-track in the process of moving into a farmyard, which is surrounded by stone-built walls and barns, prior to the men getting out to occupy the buildings of the said farm. It—the half-track—has just entered the yard when a hidden bazooka team lets off a well-aimed round which destroys the vehicle and accounts also for no less than three men (not including the officer). The survivors, of course, are placed next to their destroyed vehicle, away from the direction whence came the enemy fire (not that this mattered in this case, as the jubilant bazooka team—for the sake of the story—pulled out forthwith and disappeared).

What have we got now ? Again, naturally, we start with the initial 10, and with this in hand, in a manner of speaking, we roll the one die. This turns up an exceedingly feeble 1 ! Adding this to the 10, we get but 11—not so good. Now for the deductions, of which the first—*Control*—does not have to be made, the officer being still alive and kicking ! The second—*Cover*—requires a little thought. As has already been stipulated, the vehicle does not provide cover on the actual ' debussing ' move, but we must not forget the stone walls of the farm buildings. These are close enough to afford the men considerable ' hard ' cover, so—*plus* 1 in this case. Third factor—*communication*—a minus here, as the walls and so on which on the one hand afford protection on the other effectively screen our section from the H.Q. Company, and, there being no radio contact—minus 1 is the effect. Now for *Casualties*. Three men were lost in the ' brewing-up ' of the half-track—this constitutes over a quarter of the section's establishment, so minus 1 again. *And*, the morale rating is being taken on the move immediately after the vehicle's destruction, so again minus 1. Summing up the plusses and minuses, we have plus 1 and minus 3, which by a bit of artihmetic, and working on the 11 we had to begin with (including the dice throw), gives us at the same time a severe shock and a total of only 9 ! This, as has been pointed out, indicates that the section is of poor morale at this particular moment, and will not for the time being at least carry out the orders it has been given. What happens we shall see in a moment.

The two examples given should provide a fair indication of what the morale business is all about. Sometimes it might be found necessary for a third opinion to be called in to arbitrate between two players on some point providing disagreement, say, whether a unit is in cover or not, or how near the cover must be to give adequate protection. The question of visibility is easy—it should have been determined at the outset of the game by dice throw. Generally speaking, if a situation is treated logically and with some regard to what would have happened in ' the real thing ' not a great deal of difficulty should be experienced in dealing with morale.

Now for what happens when the Morale Rating is, as happened in the second example we gave, a ' bad ' one. What would probably take place in those circumstances ? It seems highly likely that the men involved would simply ' hit the deck ' and remain there until they had gathered their wits about them and decided just what they were going to do, either to extricate themselves from a difficult position or carry on with their designated job. This is precisely how we operate on the wargame table, and we stipulate—making another rule to be added to the list—that—

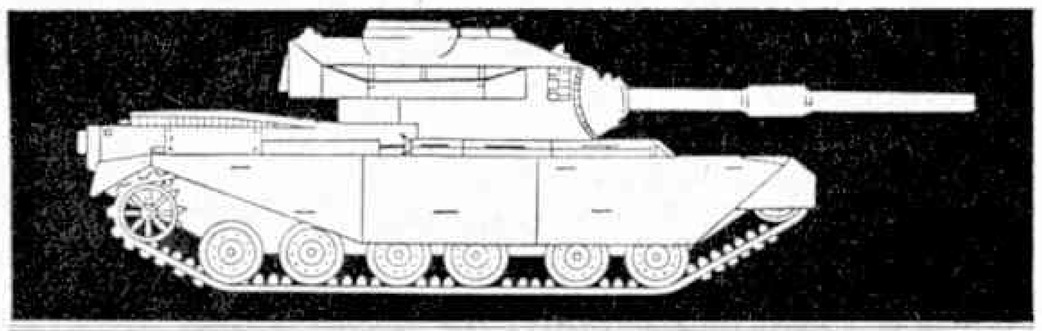
> " When a unit or section has had a bad morale rating following casualties, then it will remain halted in the position occupied for one clear move."

In brief, if we say that the casualties were suffered on Move 4, then before Move 5 can take place, the Morale Rating must be ascertained. If it is ' bad ', then on Move 5 the unit remains halted. Simple, really ! And how do they recover ? Again a Morale Rating must be made, and the die rolled once more. In the case of our second example, anything but a throw of 1 would restore the morale, provided no further casualties have been inflicted and the other factors also remain unchanged. There is thus a pretty good chance that the section will be all right. If so, then it simply carries on with what it was doing. If, however, for some reason—another dice throw of 1, or through additional casualties, for instance—the Morale Rating is again less than the required 10, then the unit, having suffered two successive ' bad ' Morale Ratings, is in a much poorer way, and this being so, it must now begin to fall back, and it retires its normal distance on this move. Again, before the next move, it requires yet another Morale Rating, and if this be ' good ', the retreat stops and the section may, on the following move, retrace its steps if so desired. *If not*, back it goes yet another move and this process is continued until the unit has had *five* successive bad Morale Ratings, this entailing the first ' halt ' one and four withdrawal moves one after the other. When this happens, it must be assumed that the section or unit is in such poor spirits that it is no longer fit for action and must continue to retire until it has actually left the wargame table.

All this has applied to the standard infantry section—or what is *my* standard section—but the system operates similarly with any other group, the separate sections of the Headquarters Company being assessed individually in exactly the same manner.

I hope all this has been reasonably clear, but at the same time I must point out that what we have considered is merely a *basic* morale rule, which can be readily adapted to individual taste and circumstance, and additions to it can easily be made. One immediately suggests itself in the case of a retreating infantry section's being ' rallied ' by a senior officer, say when the battalion commander attaches himself temporarily to a group falling back. Obviously his presence would have—it is hoped—the effect of restoring morale. We might say then that, should the battalion commander be present, an addition of 2 might be made as an additional factor when the Rating has next to be made. It might be that this would bring a ' shaky ' rating up to the necessary 10, and allow a group to get back into the thick of things.

Many other circumstances can readily be considered, but they are really for the individual wargamer to decide and he can get tremendous fun and satisfaction in doing just that.

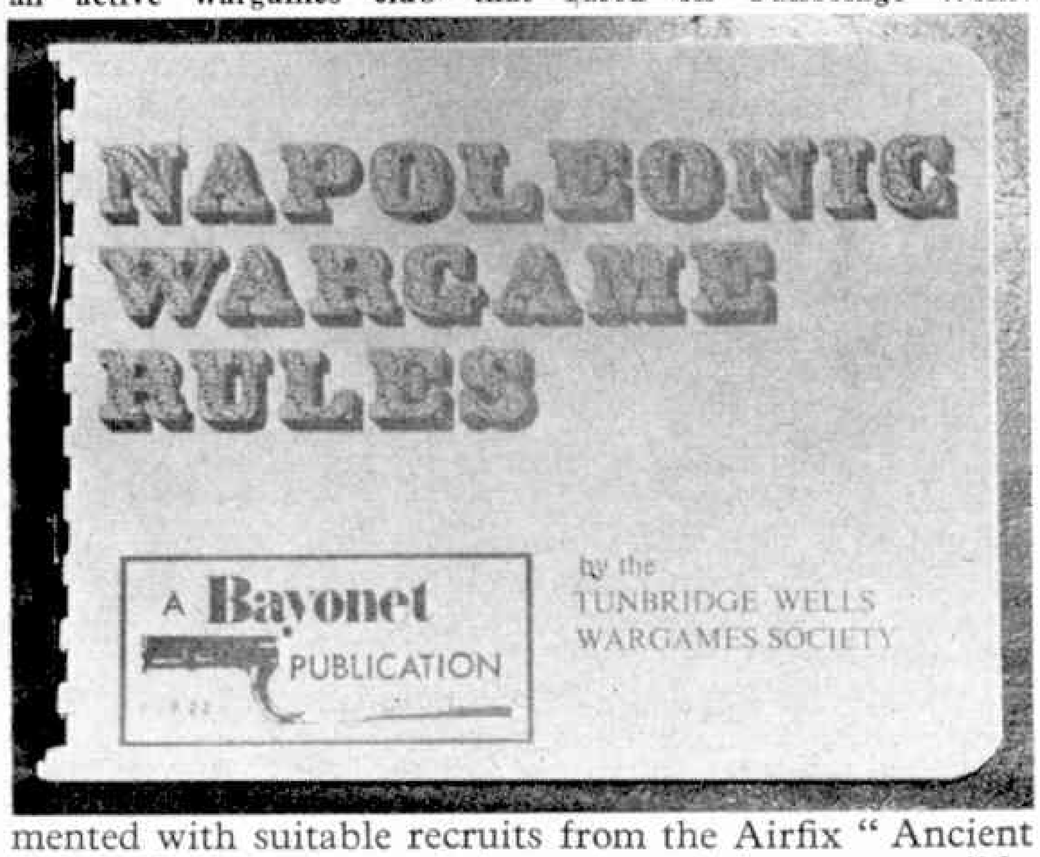


# MILITARIA

A REVIEW BY CHARLES GRANT

SOME TIME AGO, in the October 1969 number to be exact, I 'wrote up' the Roman bireme produced by Aurora Plastics Ltd. (Green Dragon House, 64/70 High Street, Croydon, Surrey). Now it is time for a look at another historical vessel from the same firm, and the photograph shows it to be a very fine Viking longship, complete with crew, both standing on guard on deck and sweating at the oars. Apart from the elaborate stand, which I'm not too keen on, the whole thing gives an excellent impression of the sinister and dreaded ships which ranged our British coasts a thousand years ago (I'm not surprised at the effect they had, when looking at the fearsome dragon-head on the bow!). The figures of the crewmen are much more to scale with the actual ship than was the case with the bireme, and they could of course be augmented with suitable recruits from the Airfix "Ancient Britons" box, some of these chaps being not terribly unlike the later Vikings with winged and horned helmets. The model is a good one altogether and should give an excellent 'period' atmosphere to a wargamer room, especially if 'ancient' games are played therein. Again this is a kit one has to seek out, not every shop stocking it, but once found it is comparatively easy to make up, not too many 'fiddly' bits to cope with.

**A useful set of rules for a Napoleonic Wargame published by an active wargames club—that based on Tunbridge Wells.**

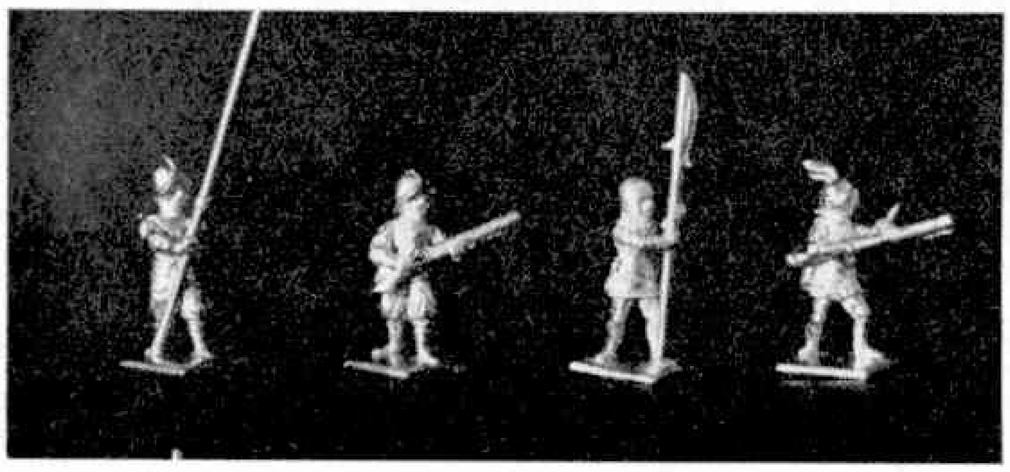


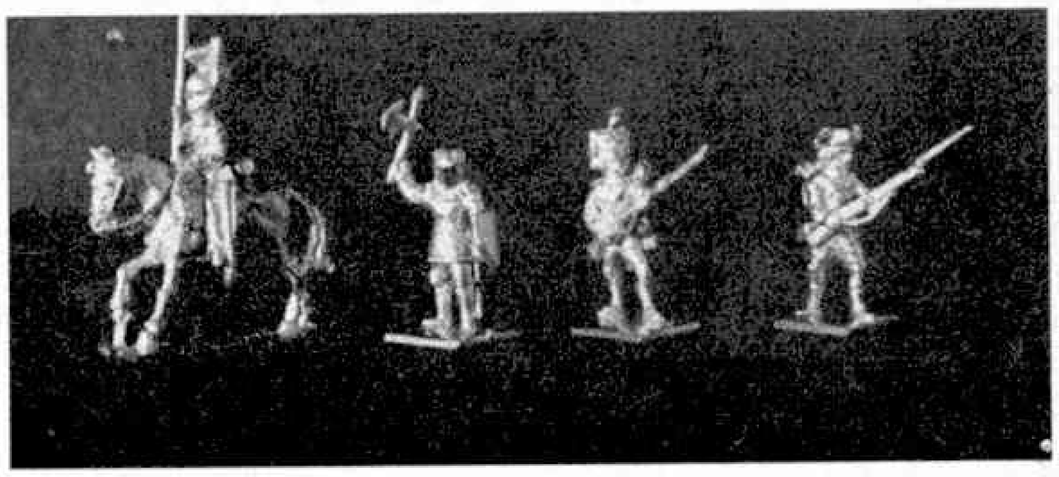

One of the most active wargaming clubs in the south of England is the Tunbridge Wells Wargames Society, which has just published a very nicely put together book of rules for a Napoleonic period game. It has one of these spiral-backed devices which allow the volume to lie flat on the table (very useful when consultation takes place during a game) and it contains a 'pocket' in the back flap which holds templates for canister and shell fire, and a species of 'grid' for calculating fire from roundshot. The canister 'profile' as it is called is the only thing I'm not too happy about, as it more or less resembles the old elongated triangle sort of device which I feel does not present a true picture of the area swept by a round of canister. Still, like so much in the wargame, this can be debated ad infinitum, and certainly there is nothing else in the rules which can be faulted. Morale is satisfyingly catered for and such niceties as giving additional power to the first volley of a unit in a battle is also taken care of adequately. A lot of thought has gone into these rules, and I'm quite sure a lot of practice as well, and I assess them as being the best relating to their particular period which have yet been published. Cost is 5/- and they can be obtained from Bayonet Publications, 27 Ramsgate Road, Margate, Kent. (Add a shilling for postage, etc.)

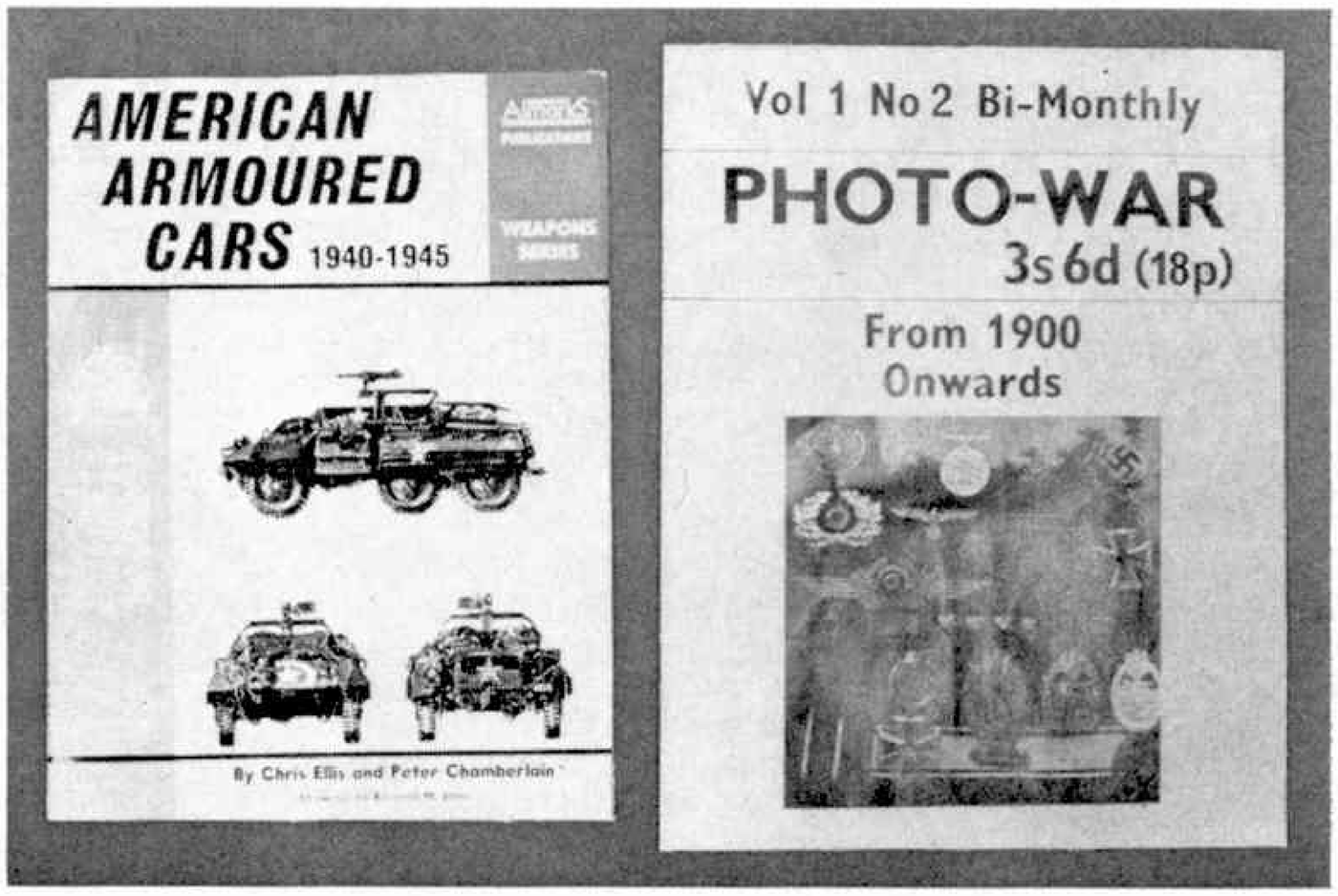
One feature of the present day study of militaria is the avidity with which people fall upon stuff dealing with the German Army of 1939—the Nazi lot. Certainly the uniforms of German troops of the period were extremely smart and variegated and I suppose that the cult is not unlike the much longer-standing interest in this country in things Napoleonic. I find it mildly surprising, but be that as it may, I have had a copy of "Photo-War" a bi-monthly magazine which deals largely with German uniforms, medals and so on. The journal is well-produced and lavishly illustrated with photographs. It contains articles on uniform, reviews of books and details of military equipment, mostly German, of World War II vintage generally. For collectors who find it impossible to acquire the 'real thing' in the way of badges and other bits and pieces they crave, the publishers advertise a series of plastic reproductions of German insignia. These cost 6/6 each and, as the photograph shows, look very realistic. I can see them being used as wall-decorations—arranged like horse-brasses on strips of material or leather—to provide a rather unusual decorative effect. The magazine costs 3/6 per number and is published by Dennis Palmer, Dept. D, 38 Pebble Hill Caravan Park, Radley, Abingdon, Berkshire.

It is highly disturbing for a wargamer to come across any new figures belonging to a period of history he has not yet dabbled in, for the temptation to plunge into an orgy of buying and painting is very hard to resist. This

**Some examples of the splendid 20 mm. metal wargame figures from Miniature Figurines of Southampton—the late medieval and Thirty Years War ones being particularly good.**





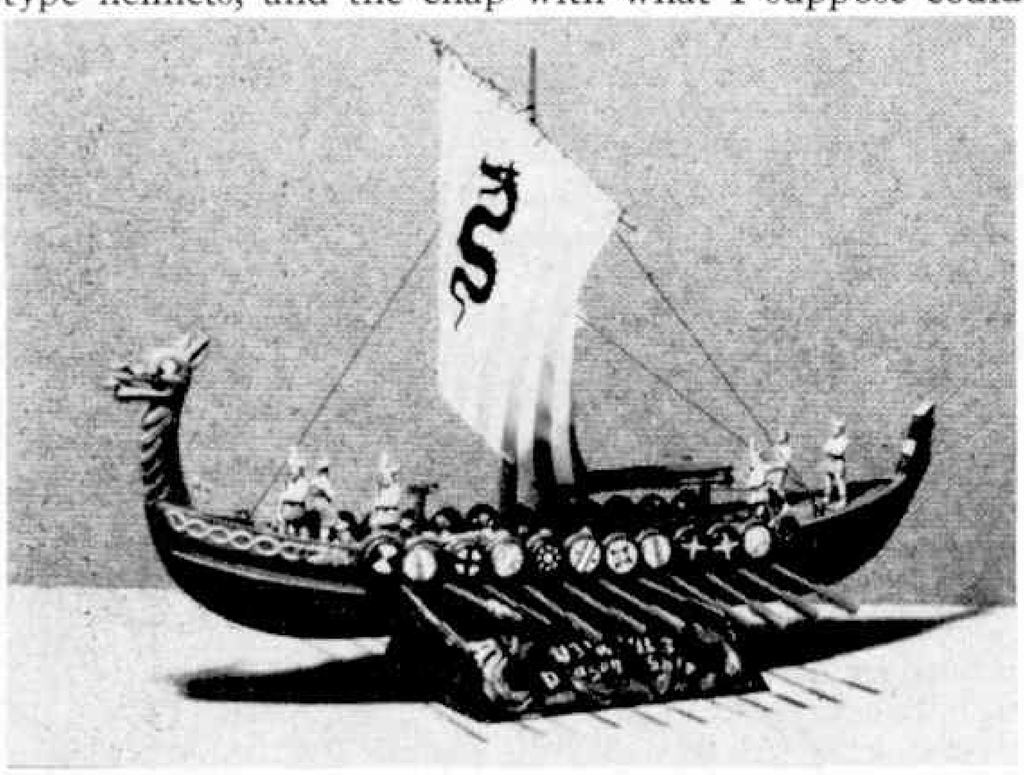



Near right : A very nicely produced book from the well-known firm of Almarks—the transfer people.

Far right : A new magazine for collectors interested in militaria—especially of the 1939 period.

Below : The very realistic looking Viking longship by Aurora Plastics Ltd.

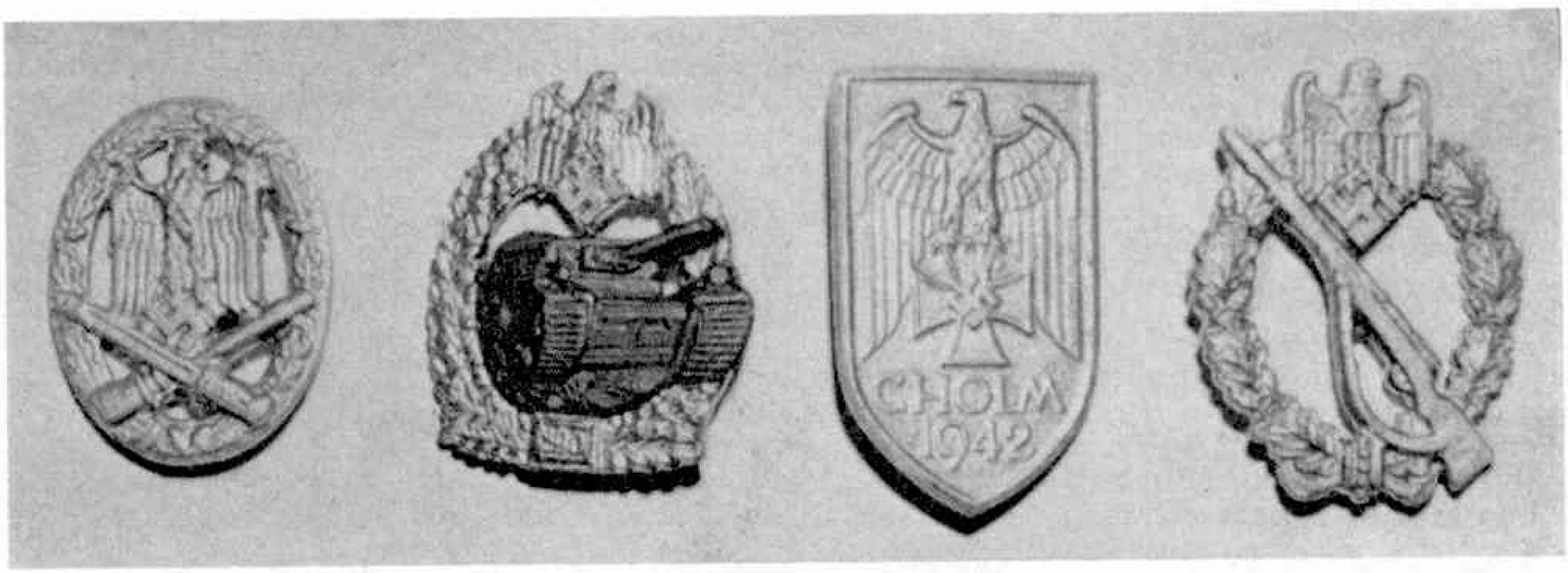
was the case with me when I had a first look at the latest medieval and Thirty Years War figures from Miniature Figurines (5 Northam Road, Southampton), and an examination of the photographs will show just why. The pikeman and musketeer with the morion-type helmets, and the chap with what I suppose could



be described as a ' hand-gonne ' are absolutely first-rate. I have watched with the greatest interest the progress of Miniature Figurines since the firm first started production five or six years ago and have seen how their first 20 mm. wargame figures have improved out of all recognition. The firm's designer, Dick Higgs, is to be congratulated on the standard of his latest ' masters '. The amount of research which has had to be done, even in the case of 20 mm. figures, is prodigious if one is to produce something historically accurate, and he certainly seems to have done this in those illustrated. Also shown is a French Napoleonic " chevau-leger-lancier " plus a couple of " horse-and-musket " infantrymen advancing in that best of all wargame attitudes, the ' high port '. Prices are the same as before, at the time of writing, that is, a shilling for an infantryman and 3/- for a mounted figure.

Almarks Publishing Co. (104-106 Watling Avenue, Edgware, Middlesex) has broken new ground with a most attractive book, first it is to be hoped of a " Weapons " series. The firm has hitherto been known principally for the excellent series of military vehicle and aircraft transfers, so invaluable to the modeller. The volume is " American Armoured Cars 1940-45 " and the authors are that prolific and authoritative pair, Chris Ellis and Peter Chamberlain. These two names should be enough to establish the quality of the book, which, incidentally, I found a particularly nice and well laid-out bit of work. It is extremely well illustrated, both with photographs and line drawings, and the text is in two parts, the first dealing with the general development of the armoured car in 1940-45 and the second with the American production of cars in the same period. Technical details abound and the coloured illustrations inside the covers are most attractive. The price is moderate—12/6—making the book a ' good buy '.

Plastic reproductions of German Army badges—published by the magazine " Photo-War ".



## MATCHBOX FORD G.T. (No. 45)

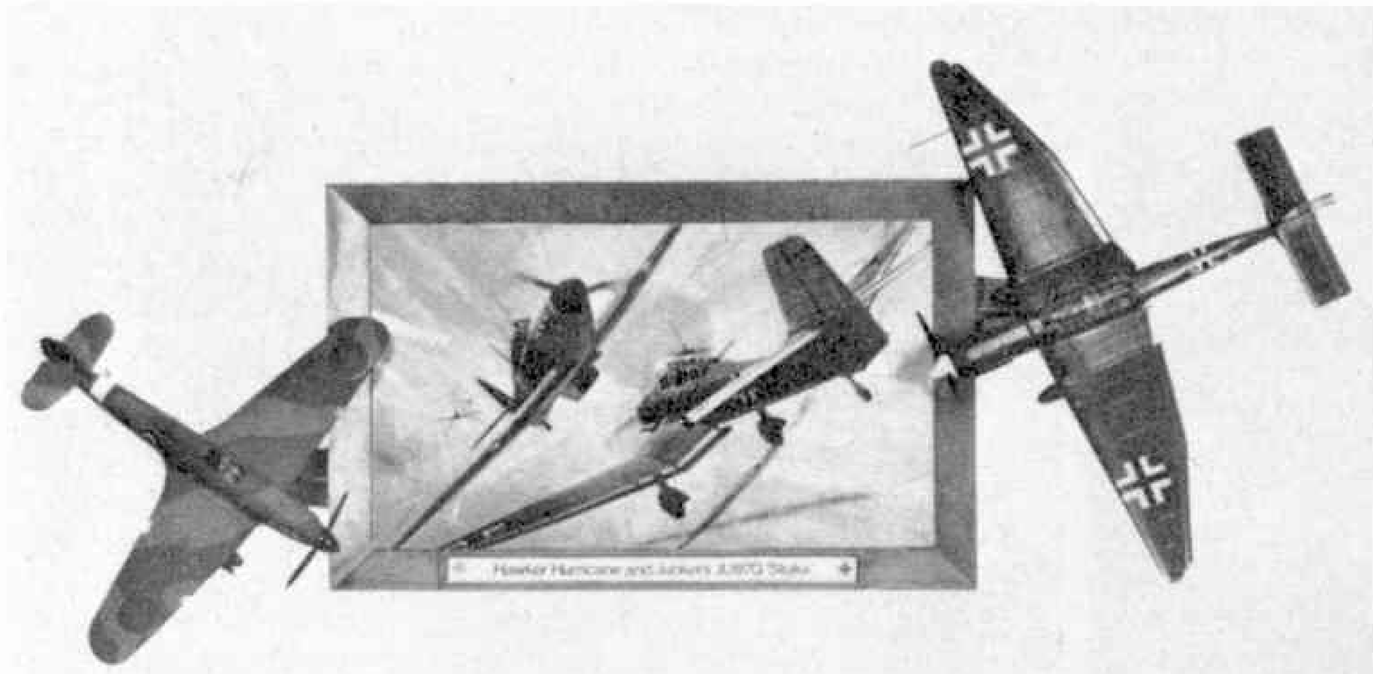
Finished in a beautiful and flawless metallic green, this new Ford Group 6 car from Matchbox is one of the nicest die-cast models we've seen for some time. Its sleek body is an excellent copy of the original and its low centre of gravity will make it a fast mover on the Superfast track. The model is fitted with wide wheels and wide racing tyres, suspension and a detailed interior in white. Clear plastic windows are fitted and through the rear one can be seen the detailed chromium plated engine.

Very reasonable priced at 2/8d, this model should prove to be very popular.

## NEW FROG KITS

What to do with a steadily increasing collection of plastic construction kits is a problem every enthusiast is bound to face at one time or another. The obvious solution is to arrange them on every available shelf, or in the case of aircraft hang them from threads attached to your bedroom ceiling, but there comes a time when either all available space is occupied, or Mum just says, " That's enough ! "

The large plastic kit producing firm of " Frog " have come up with a new practical solution to the problem, with their new range of " Battle-of-Britain " kits. Included in each kit (which by the way contains *two* aircraft) is a plastic picture frame, complete with appropriate full colour picture, which can be hung on the wall, and the completed aircraft fitted to the edge of the frame ! The result is a new area of space used to keep the models, and secondly a very attractive setting in which to display them.



There are at present three kits available (all are 1/72nd scale). A Bristol Blenheim Mk 1 and Messerschmitt BF 109F: A Hawker Hurricane and Junkers JU87G " Stuka " and finally a Spitfire Mk 1A and a Junkers JU88.

All the kits fit together well and look very realistic when finished. A separate sheet of instructions are included for each aircraft, and are well illustrated. The colourful box serves as a useful guide to painting the models, and at between 10/6 and 12/6 per kit represent excellent value for money.

Manufacturer: Frog.

## NEW CORGI MODELS

Recently released from the Corgi stables are two new models to add to the already impressive line up for 1970. The first is an eyecatching replica of the American " Pontiac Firebird " sports car, and is a little gem as regards detailing. The model is finished in metallic silver paintwork, with the now fashionable

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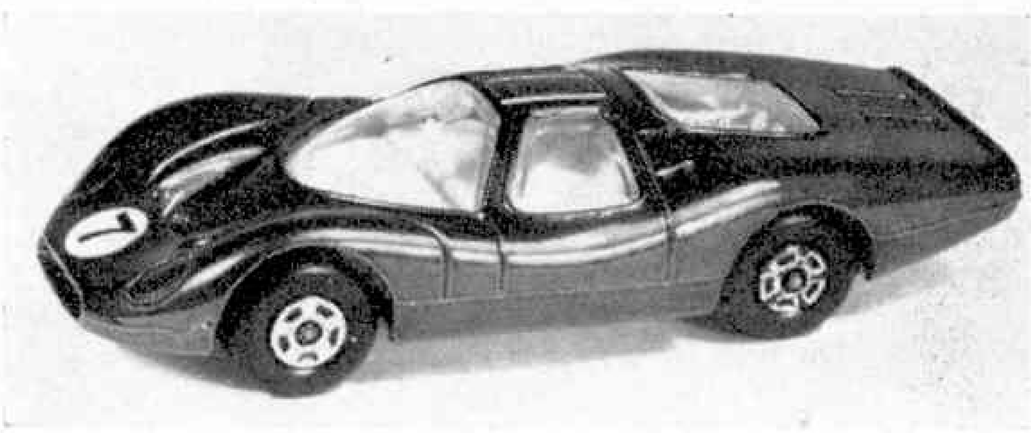


anti-dazzle matt black bonnet and twin stripes on the bootlid and similarly treated in black is the hood, moulded in the " down " position.

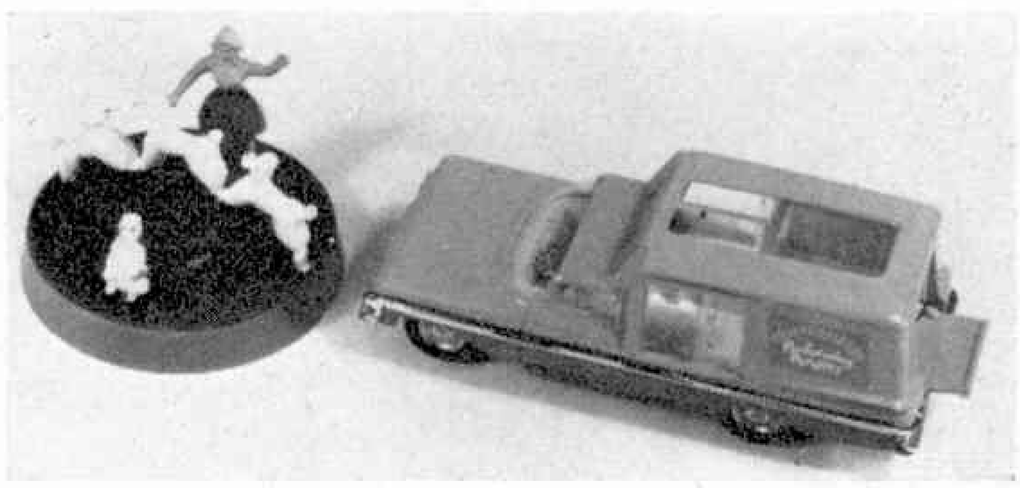
The doors open to reveal well detailed interior door panels in bright red plastic, a pleasing contrast to the silver. The interior, moulded once again in red, is a wealth of detail. Twin tip-formed front seats, detailed upholstery, fully instrumented dashboard, chromium plated gearstick and a gold plated steering wheel give the overall impression of authenticity. Both radiator and front/rear bumpers are chromium plated, as are the two impressive air scoops on the bonnet. This model is fitted with suspension on all wheels (which are of course, " Whizz wheels ") all adding up to a very attractive model which is reasonable priced at 8s. 11d.

**Above :** The beautiful new Matchbox Ford G.T.

**Left :** Frog's new approach to plastic kits.

**Below :** New Corgi Chipperfield Circus Chevrolet Impala.

The second release is a very unusual one indeed, and is described on the box as (wait for it) a " Chipperfields performing poodles Chevrolet Impala! " This



model is really in two parts. A chevrolet van and a plastic base on which stand six performing poodles and their trainer.

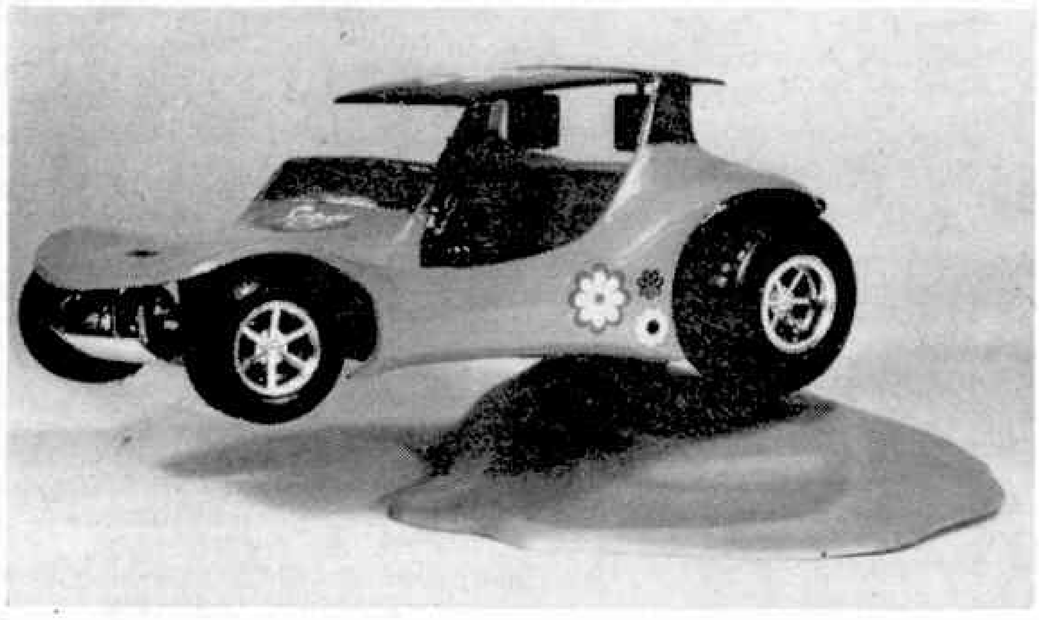
The Chevrolet is rather like an ice-cream van in general appearance, and is finished in pale blue and red, a chromium strip separating the two. The cab section is complete with dash board and seats in pale blue, and a steering wheel in silver. The " van " section, also in pale blue has a clear plastic roof, sliding windows on either side, and a drop-down tailgate. The suspension on all four wheels is very soft indeed, and the model when pushed wallows from side-to-side, very much as many American cars do!

The second part of the model consists of a green, circular plastic base, on which are fitted four white plastic poodles and two black ones, all in various attitudes. Rounding off this display is a small plastic figure of a girl instructor. Price of this one is 12s. 6d.

Manufacturers: Corgitoys.

## MONOGRAM BUGGY

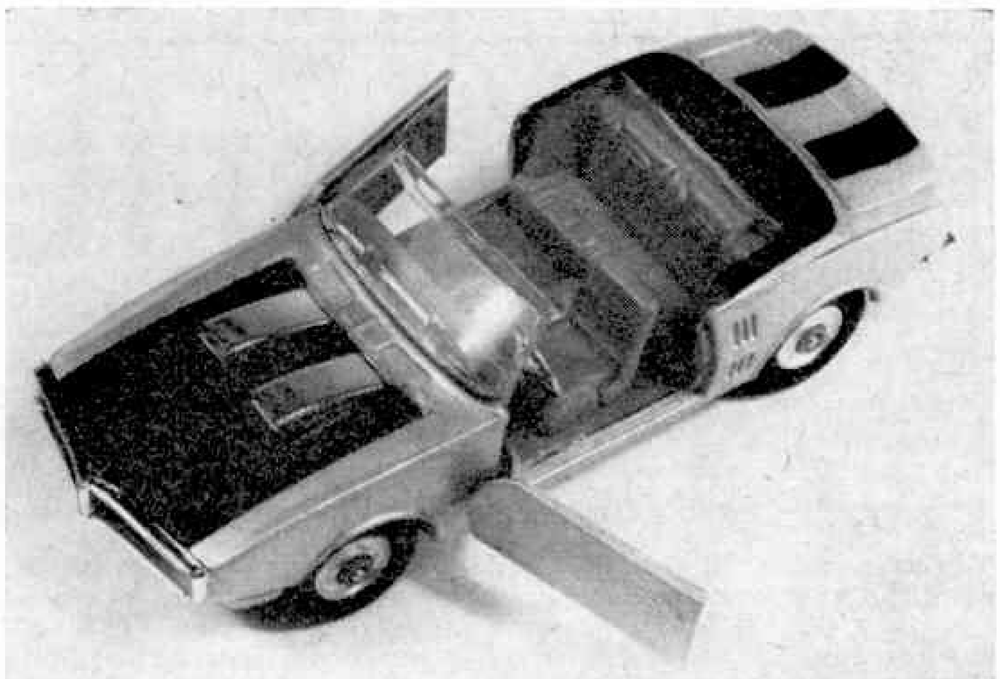
Rapidly becoming a big craze in America at the moment is the beach buggy. With the availability of Volkswagen engines and cheap fibre-glass bodies, almost anyone can afford to build one of these unique little vehicles. Definitely the cheapest buggy available is the " Sand Crab " which costs around 30s.! But the " Sand Crab " isn't the easiest of vehicles to ride



in, probably because it is only a 1/24th scale model. Yes, if you haven't already guessed it's another of Monogram's amazing " Instant Fun Cars ".

**Above : Another gem from Monogram. The " Sand Crab " Beach Buggy.**

**Below : Tri-ang's new Battle of Britain Class Locomotive.**



**Corgi's new Pontiac Firebird.**

This really is a fine looking model, packed with intricate detail. To begin, the big 1600 Volkswagen engine at the back of the model sports plenty of chrome parts, some of which are quite delicate. Moving from one end of the model to the other, the steering system on the front wheels actually works! There's more detail inside, with a dashboard, foot pedals, hand-brake, gear stick and a wood-rimmed steering wheel.

Other detail includes wide, ribbed tyres, magnesium wheels, green tinted roof and windscreen, padded seats and headrests front and rear lights and flower-power transfers. The model comes complete with a sand dune stand.

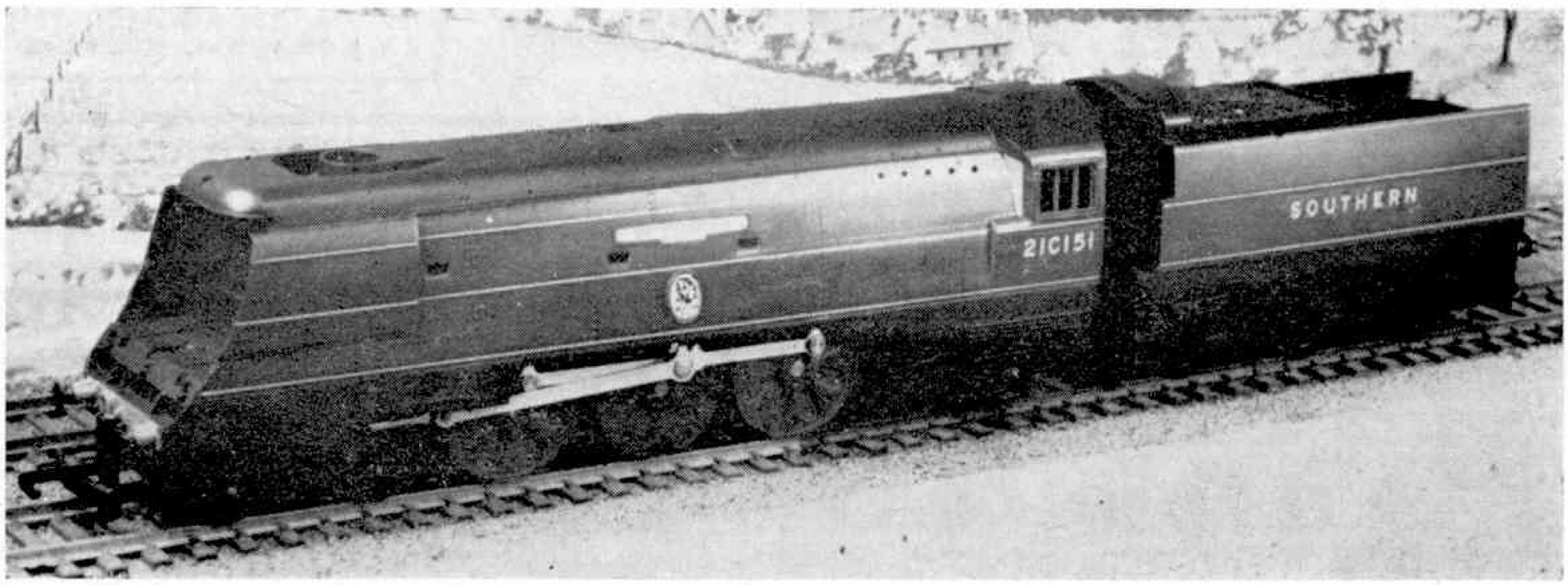
All this goes to make a really fine model that can be built not only easily and quickly, but also effectively. Another " hit " for Monogram.

## TRI-ANG " BATTLE OF BRITAIN " LOCO

This popular Tri-ang model, which S.R. fans will know well, is now available in pre-Nationalisation Southern Railway livery. As our photograph shows, it looks very well finished in this style. The bright green body colour seems to be a fair representation of the old Southern livery, and the horizontal yellow lining and block lettering add to the authentic effect.

The model represents No. 21C151 *Winston Churchill*, but an alternative choice of three names and numbers is included with each locomotive. Price, including tender and " crew ", Smoke and Magnadhesion, is £5 5s. 0d.

Manufacturers: Tri-ang/Hornby.



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Years of research has developed these colours which are as near to the real thing as the real thing itself. They provide an ultra-thin film which doesn't show brush marks or clog fine detail.

There's a comprehensive range of colours for railways —aircraft—military uniforms and equipment—ships and racing cars which you can buy in single tinlets or in kits of six*.

*Recommended retail price in U.K. Tinlet 1/9, Kits 9/9.

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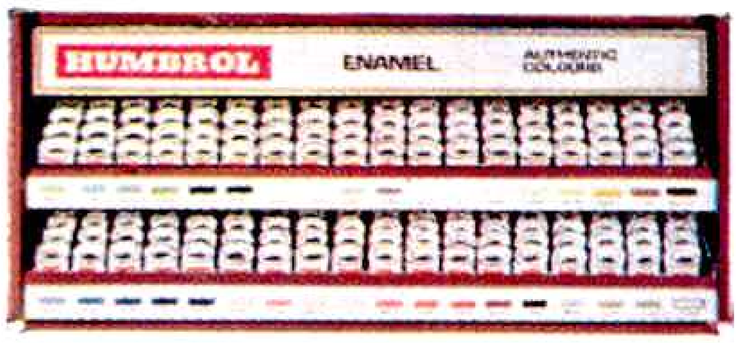


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# HUMBROL

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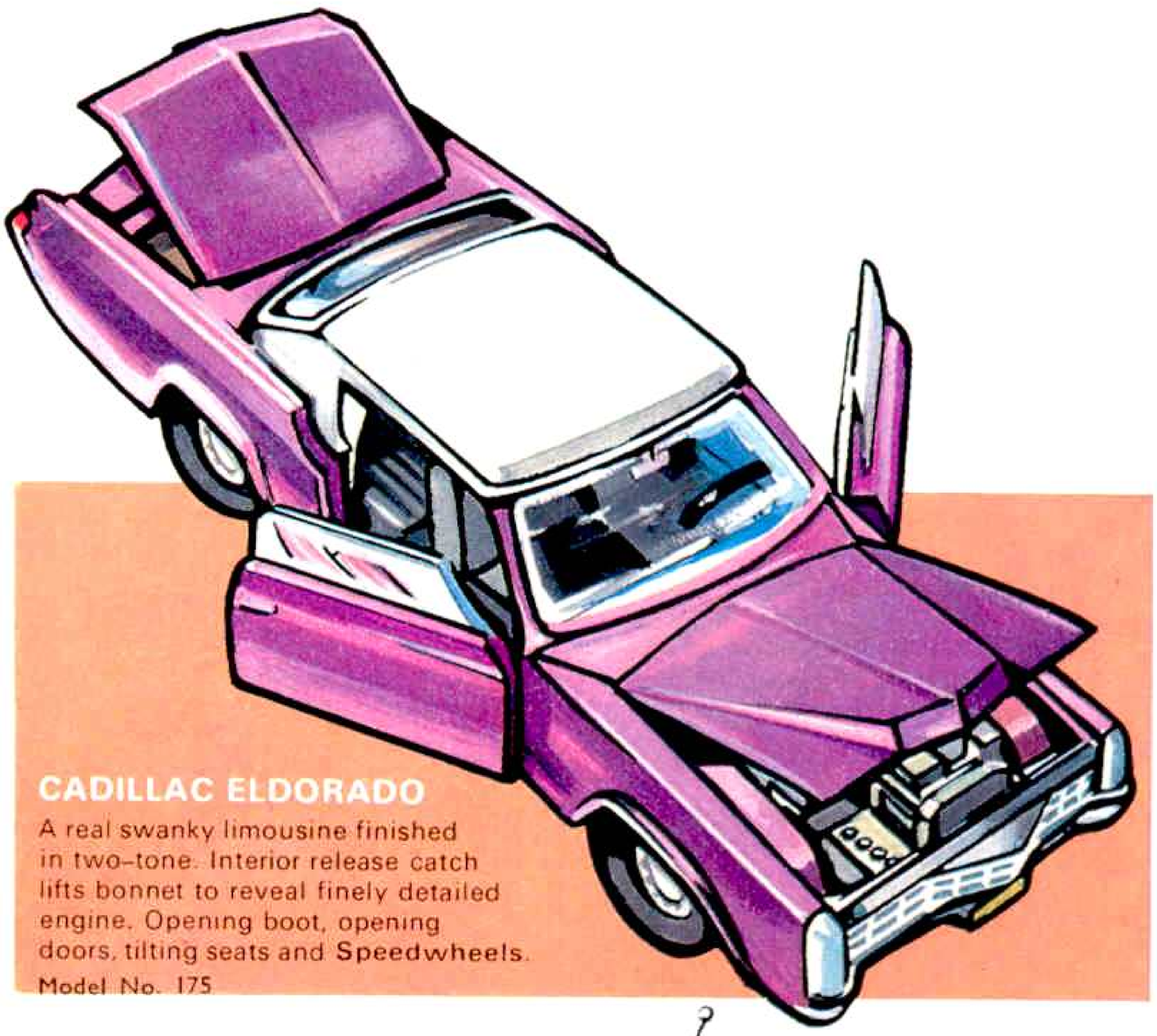
# FAST MOVIN' AMERICANS

FROM **DINKY TOYS**®

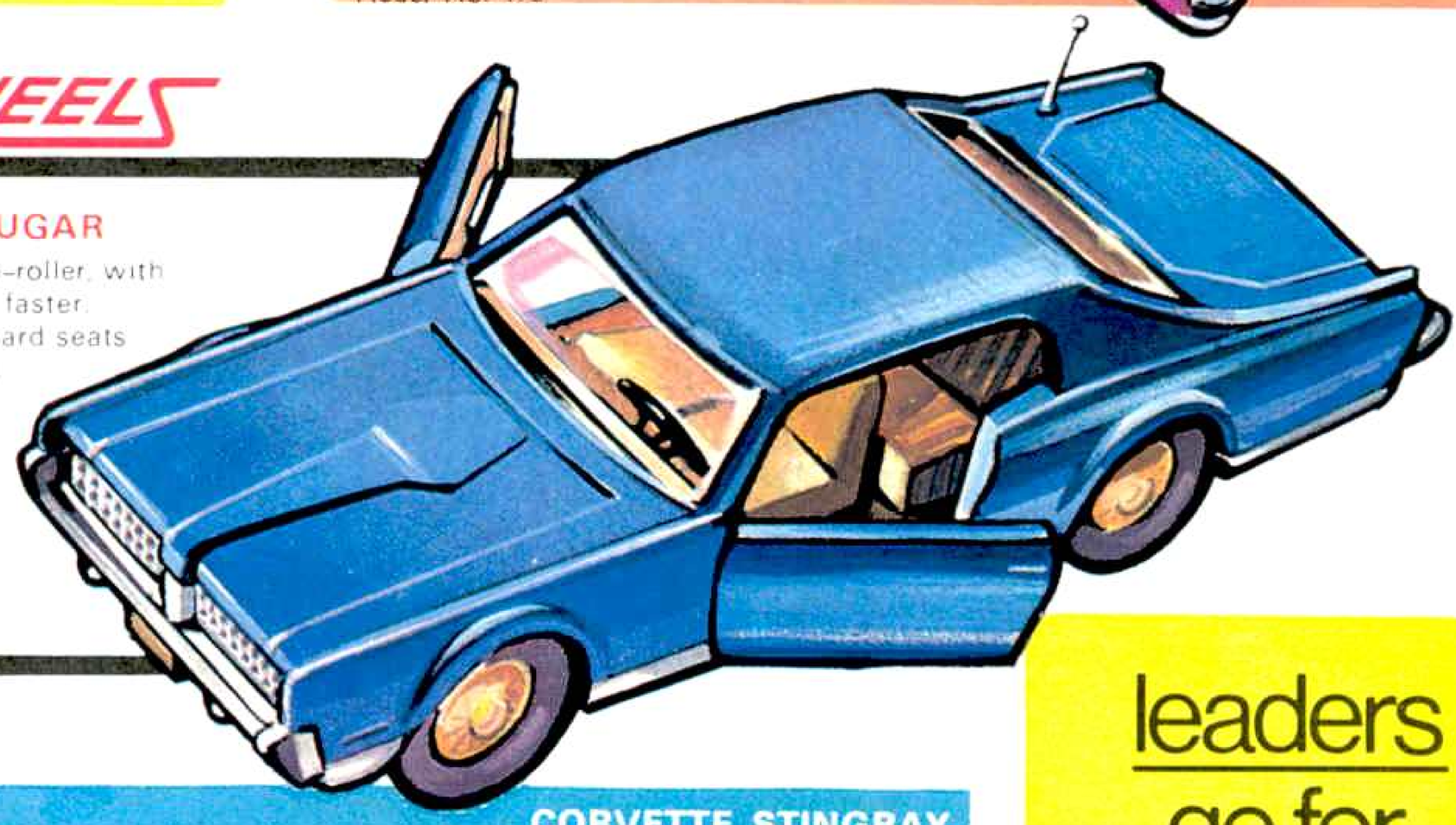
WITH SPEEDWHEELS



**CADILLAC ELDORADO**

A real swanky limousine finished in two-tone. Interior release catch lifts bonnet to reveal finely detailed engine. Opening boot, opening doors, tilting seats and **Speedwheels**.

Model No. 175



**FORD MERCURY COUGAR**

A sleek looking Freeway free-roller, with **Speedwheels** to go further, faster. Two opening doors, tip-forward seats *and* a retractable radio aerial. Smooth silver metallic trim.

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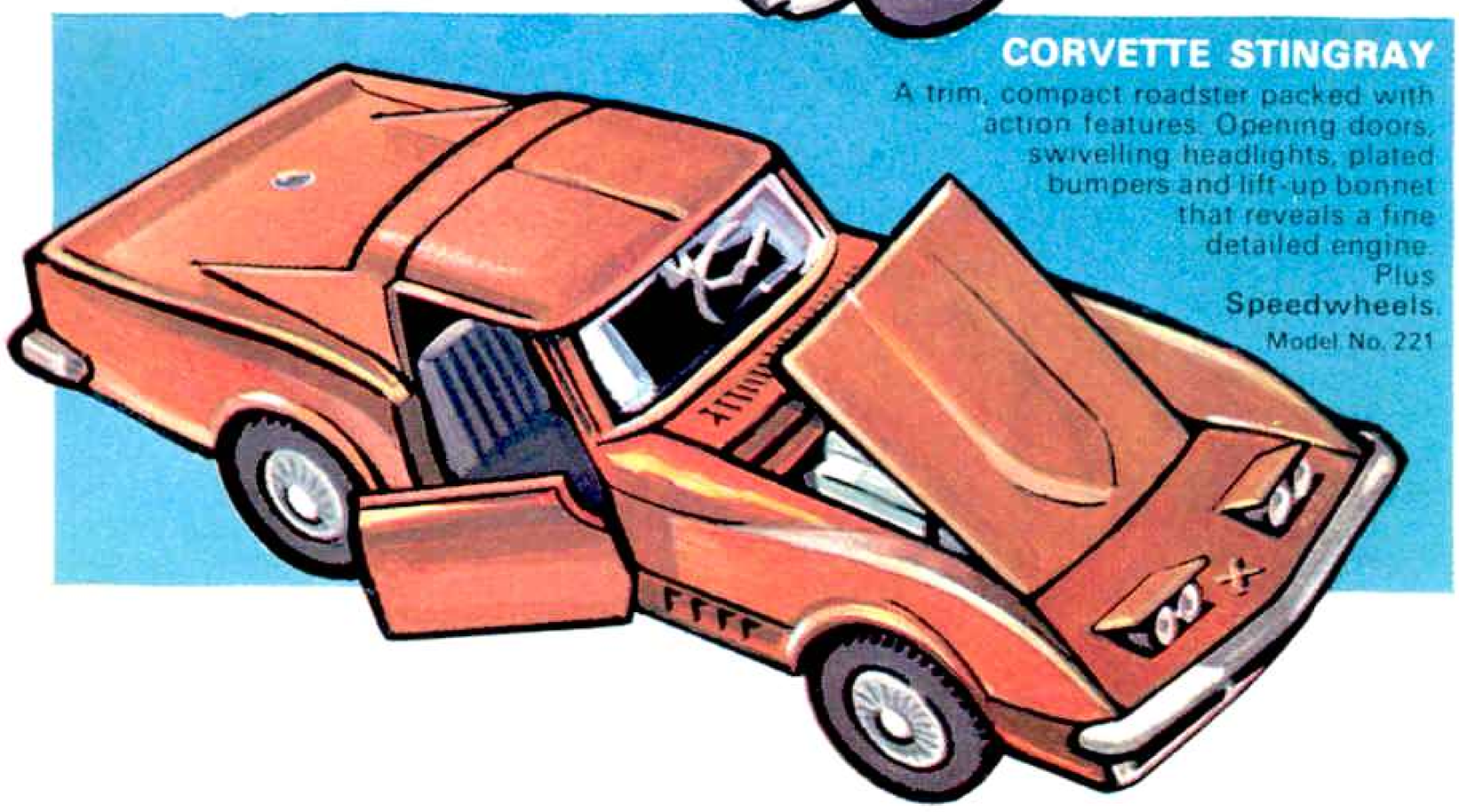

**CORVETTE STINGRAY**

A trim, compact roadster packed with action features. Opening doors, swivelling headlights, plated bumpers and lift-up bonnet that reveals a fine detailed engine. Plus **Speedwheels**.

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